(2)

ONR Grant #N00014-91-J-1540

Report Date: July 30, 1991 Quarter #: 1

Report Period: 5/1/91 to 7/30/91

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Title: Development and Enhancement of a Model of Performance and Decision Making Under Stress in a Real Life Setting

Institution: University of Maryland at Baltimore and
Maryland Institute for Emergency Medical Systems

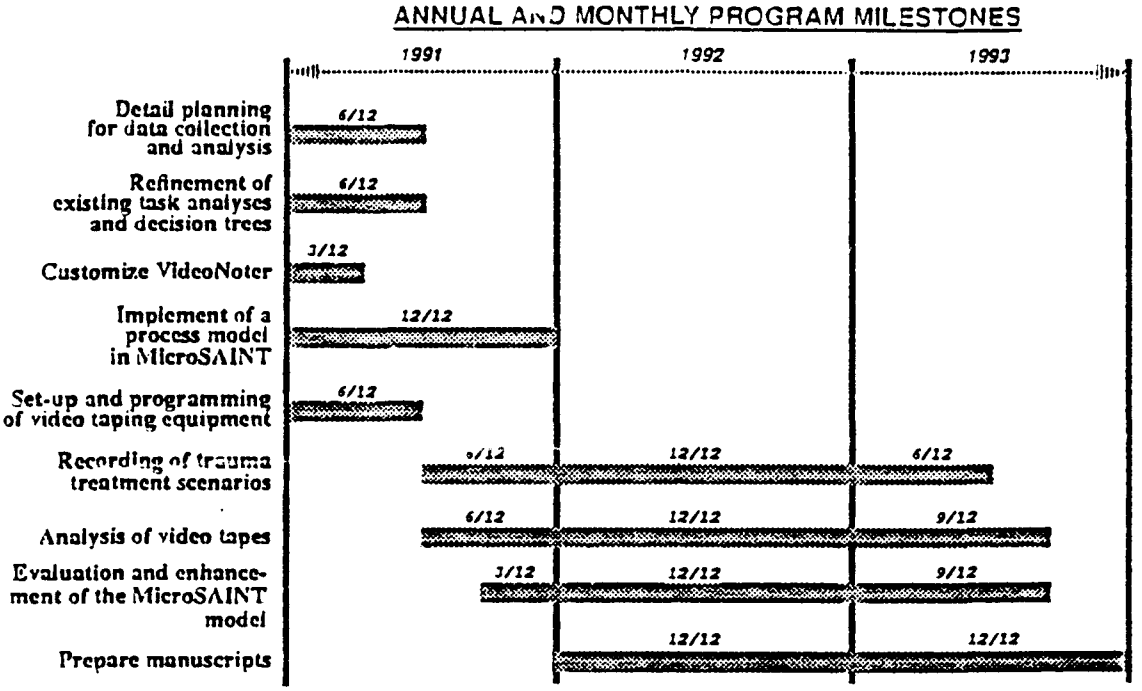
Current staff with percent effort of each on project:

		Sub-contract Man-Made Systems Corp.	
Colin F. Mackenzie	15%		
William Bernhard	5%		
Kevin Gerold	5%	Richard Horst	10%
Brian McAlary	5%	David Mahaffey	10%
Andy Trohanis	10%	Daniel T. Smith	10%
Jim Brown	10%	Karen Webster	10%
Bob Moorman	10%	Expt. Psychol GRA	NYA
Xun Luo*	10%		

NYA - not yet appointed
*Xun Luo replaces Mr. Ho (see attached under Personnel and Administrative Matters)

ONR #1 Report on ONR Grant

Program milestones identify the following objectives for this first quarter (Fig.1).



1) Detail planning for data collection and analysis (1st 6 months)
2) Refinement of existing task analyses and decision trees (1st 6 months)
3) Customize VideoNoter (1st 3 months)
4) Implementation of a process model in MicroSAINT (1st year)
5) Set up and programming of video taping equipment

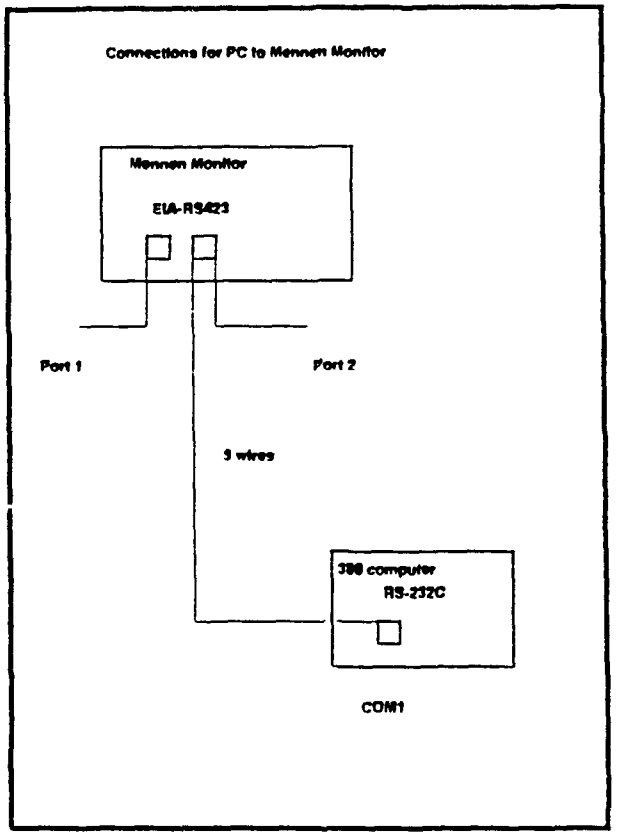
The report will describe progress made in the above 5 areas and include appendices of decision trees and publications and software applications.

Planning for data collection and analysis

The protocol for interfacing of Mennen physiological monitors in the MIEMSS admitting area and operating rooms has been written. It is planned that this will be tested in early August 1991. Data acquired will include arterial and venous blood pressure, heart rate, temperature, arterial O_2 saturation and electrocardiogram analysis. From the SARA mass spectrometer we will acquire end-tidal CO_2.

As shown in Fig. 2 we will acquire this data at each location using a 386 PC through two serial ports. We are presently investigating the optimum system for transfer of the digital physiological data to the video image and the appropriate means of time code generation. We are on the brink of ordering a system that will allow video overlay of the physiological data and enable time codes to be determined almost down to single frame speeds.

Fig. 2



The video analysis equipment will run on a 20 mHz 386 AT&T computer of the PI's. This together with other equipment to be used in this project was included in an award made to the PI by AT&T 2 years ago. The video analysis VCR will be a more sophisticated system than the VCR used for video acquisition. Details of the acquisition and analysis hardware will be provided in subsequent quarterly reports.

Refinement of existing task analysis and decision trees

Appendix 1 includes the current decision trees developed by the LOTAS group. It must be clarified that these decision trees are starting points. It is our intent to further refine these trees as the project progresses. Video analysis will enable us to identify whether or not these represent what actually happens in the real-life situation during resuscitation and anesthesia at MIEMSS. The decision trees will be iteratively developed.

The task analysis data has been received from 80 of 170 U.S. trauma centers. Twenty percent of the international task analysis surveys have been returned. Further mailings to the international centers have been sent out. The task analysis survey information is presently being collected and when available it will be described in these reports.

Customize VideoNoter

We have discussed VideoNoter with the Institute for Research on Learning (IRL). It is clear that the software does not do what they said it could. The original program is so full of bugs that they said it is unusable. There is a shortened version called VideoNoter Jnr that Mr. Rochelle of IRL has programmed. One of our group visited IRL and reported that VideoNoter Jnr does not do many of the things that we wish. For instance there is no database, the Jnr program relies on a word processing format (Word Perfect) and it is difficult to provide accurate time lines. The group at IRL use VideoNoter Jnr. to make micro analysis at much finer grain than we intend using (IRL takes 2 hours or more to analysis 25 sec of video).

We have therefore elected to use a commercially available video analysis software packet, Observational Coding System of tools (OCS tools) produced by Triangle Research Collaborative Inc. of North Carolina (Tel: (919) 549-9093). Details are described in Appendix 2 (only included in ONR reports). We believe it is a greatly superior product for our use compared to VideoNoter Jnr.

Implementation of a process model on MicroSAINT

We have obtained MicroSAINT. Examples of its application are shown in Fig.3 and 4. We assigned times to completion of the decision outlined on the Hypertension in the trauma patient decision tree (Fig. 3). Times are handwritten in on the decision points. Between the two points marked with 11 and = we ran the MicroSAINT model with the addition of a second anesthesiologist. The model was iterated 1000 times (takes about 8 min) with and without the 2nd anesthesiologist assisting between the identified portion of the decision tree. Fig. 4 shows how achievement of the reversal of hypotension was changed by the addition of the second anesthesiologist. Time is shown on the X axis in seconds. The number of occasions hypotension was reversed in that time (designated counts) is shown on the Y axis. The shaded area represents occasions where completion of the tasks between 11 and = in Fig. 3 was achieved by a single anesthesiologist. As can be seen all the points beyond 3000 sec are shaded whereas when two anesthesiologists were working together the task was achieved between 600 sec and 2800 sec.

Another example of MicroSAINT application is shown in Figs. 5-8. Fig. 5 shows the management of the difficult airway decision tree with completion times hand written on the tree. Four possible solution paths are numbered 1-4. Modelling this on MicroSAINT shows the distribution of execution times for successful intubation of the trachea (Fig. 6) when the model is run 1000 times. In Fig. 7 the number of times each of the four possible paths was chosen is shown in 1000 iterations. The time taken to complete any one of these paths is shown in Fig. 8.

These are merely examples of how we might apply the MicroSAINT modeling to our decision trees. We will of course be able to give exact times for achievement of each decision point as a result of video analysis.

Fig. 3

HYPOTENSION IN THE ACUTE TRAUMA PATIENT

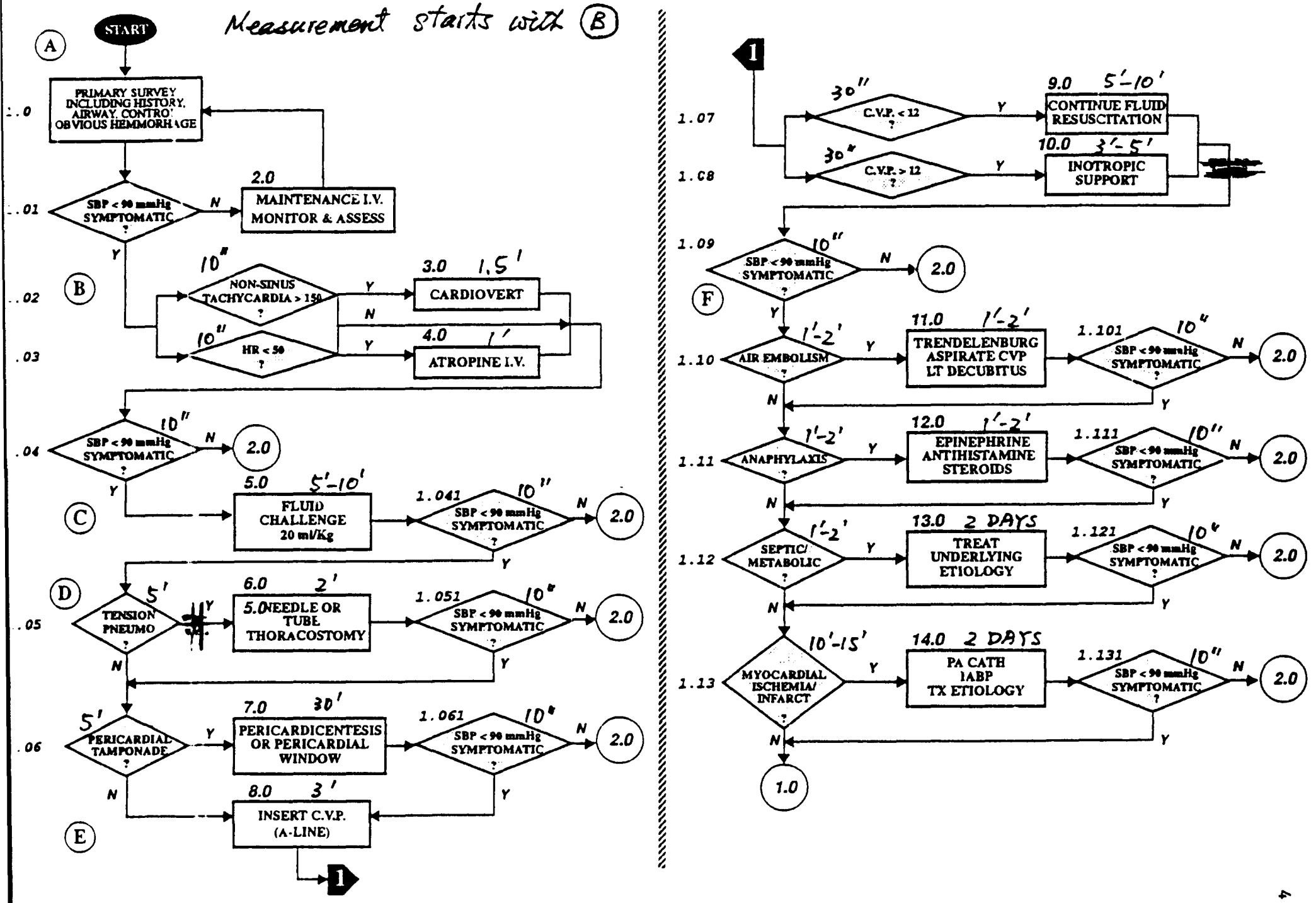
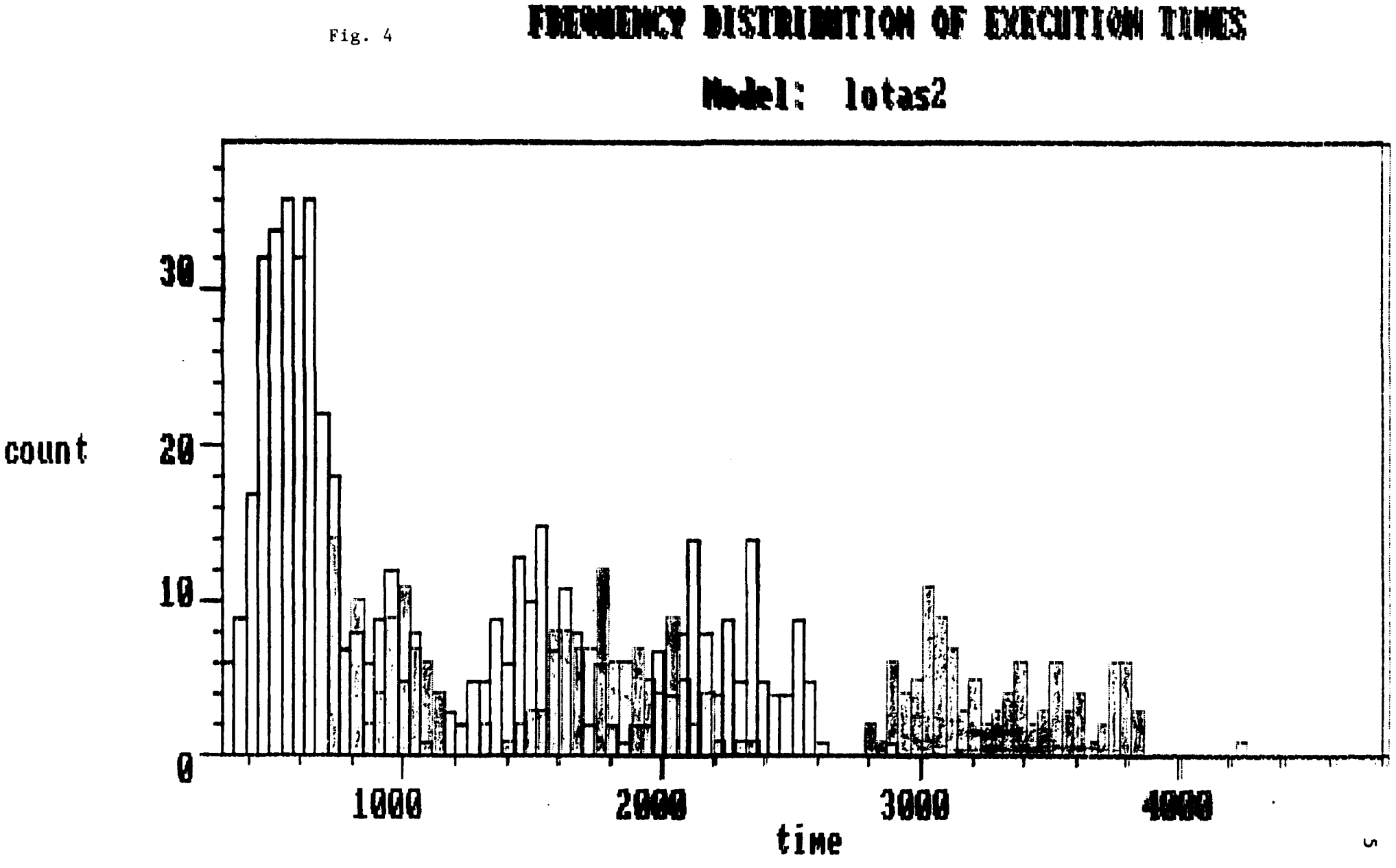
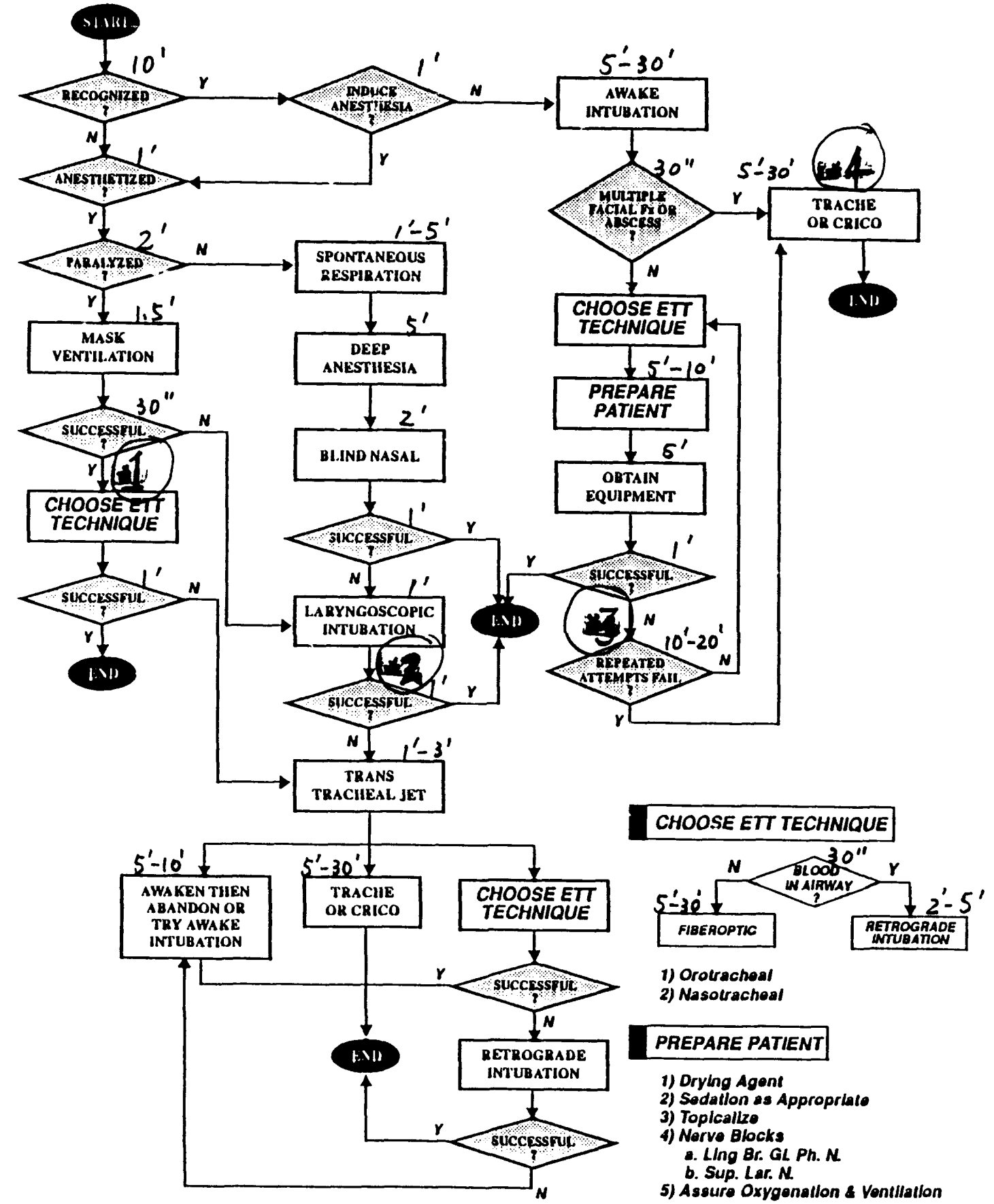


Fig. 4


FREQUENCY DISTRIBUTION OF EXECUTION TIMES
Model: lotas2
count
30
20
10
0
1000
2000
3000
4000
time

MANAGEMENT OF THE DIFFICULT AIRWAY



*O_2: undefined route

Fig. 6

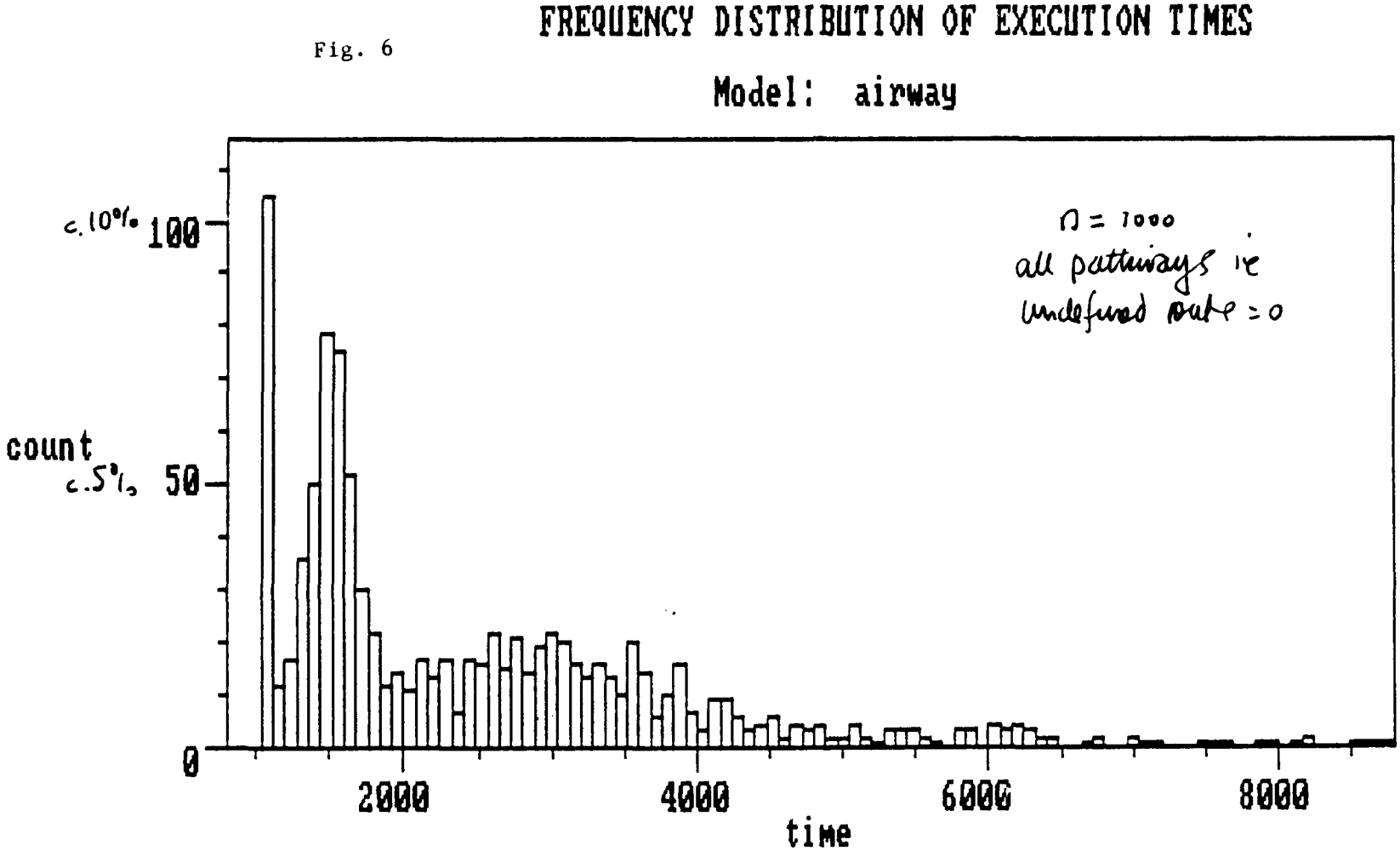

FREQUENCY DISTRIBUTION OF EXECUTION TIMES
Model: airway
c.10% 100
count
c.5% 50
0
2000
4000
6000
8000
time
n = 1000
all pathways ie
undefined rate = 0

Fig. 7

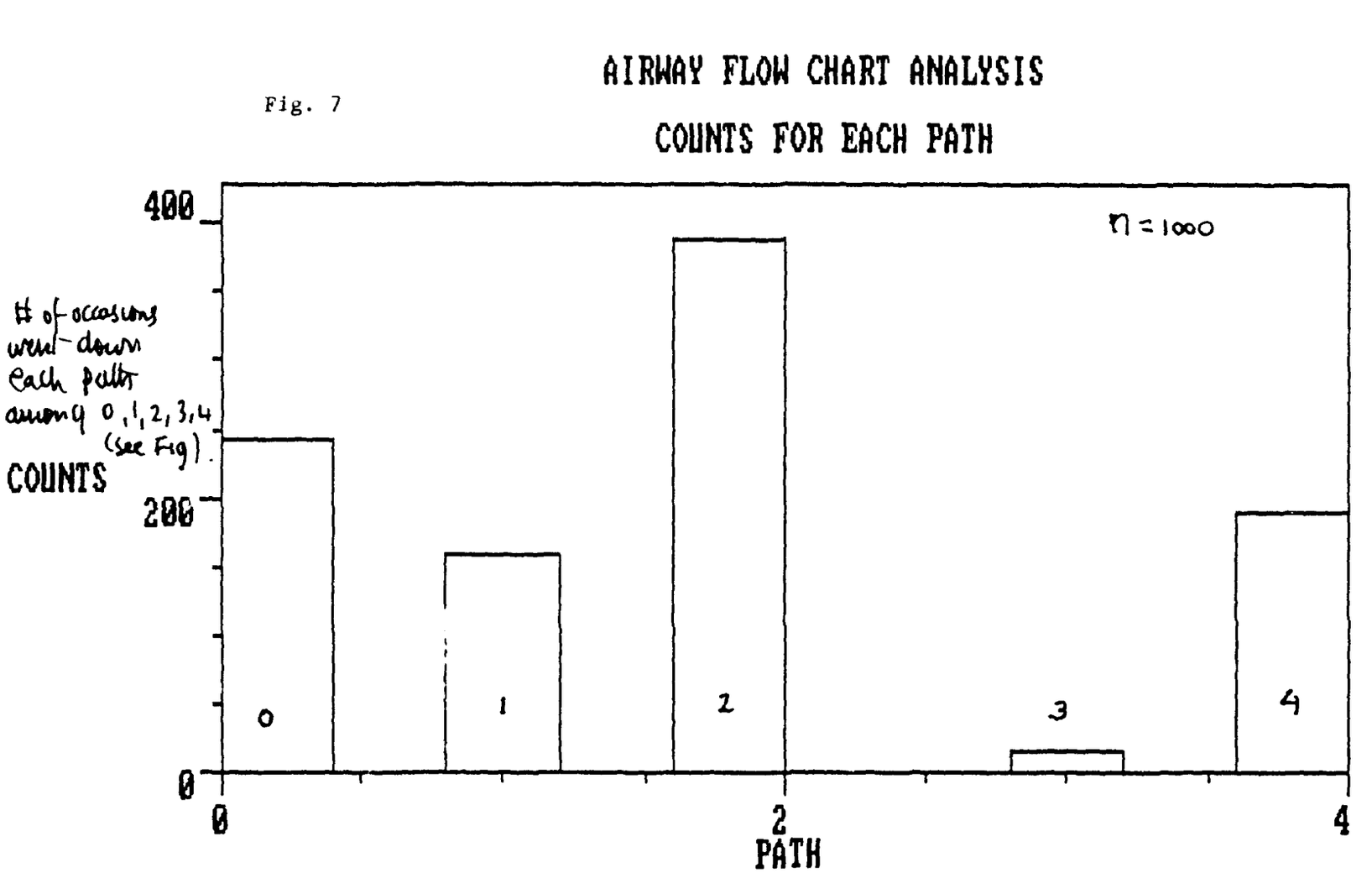
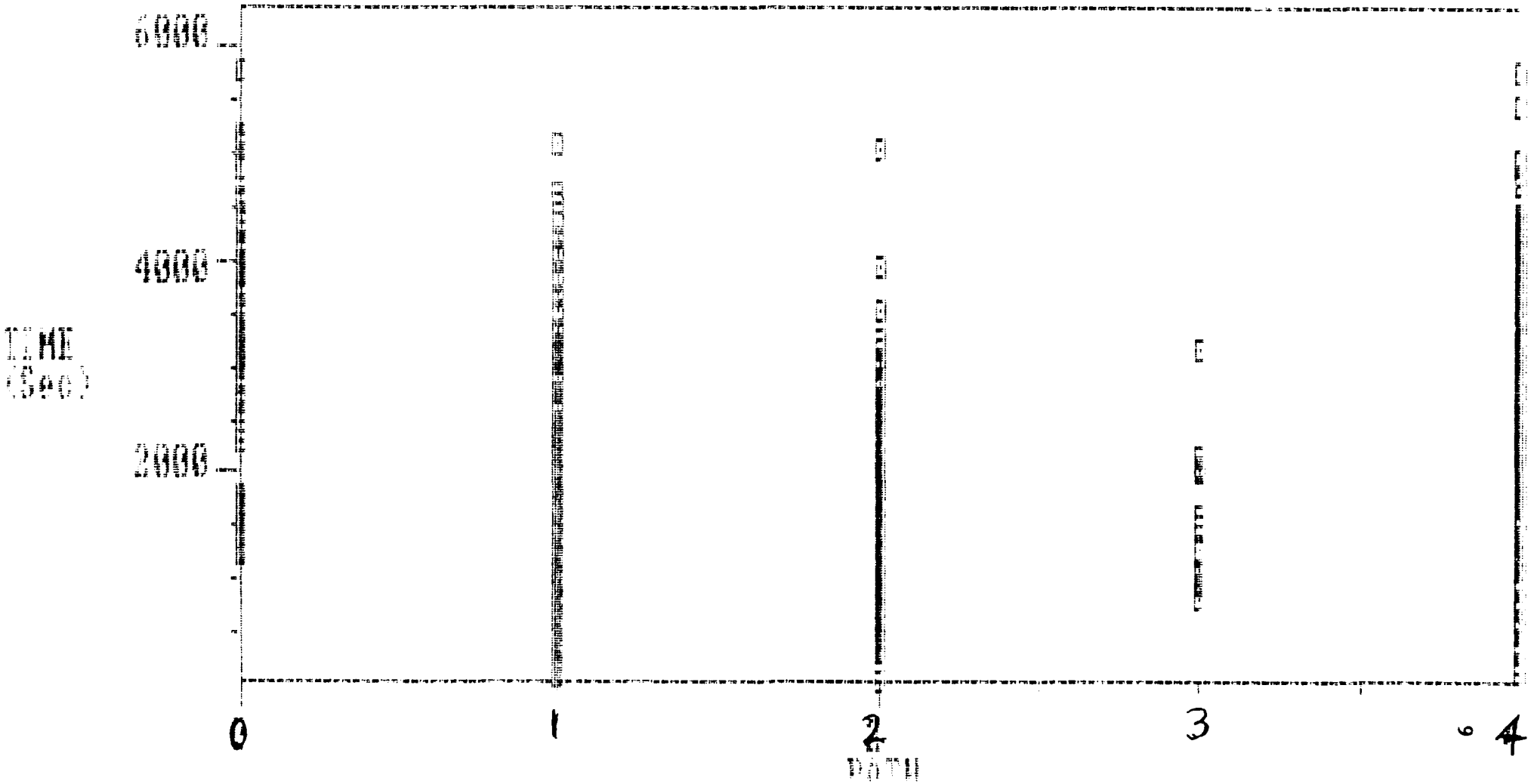

AIRWAY FLOW CHART ANALYSIS
COUNTS FOR EACH PATH
n = 1000
# of occasions went-down each path among 0, 1, 2, 3, 4 (see Fig).
COUNTS
400
200
0
0
1
2
3
4
0
2
4
PATH

Fig. 8

MANAGEMENT OF THE DIFFICULT AIRWAY

Complete Time through Different Paths



Set up and programming of videotaping equipment

We have set up one camera system with VCR for testing purposes in one resuscitation bay of MIEMSS. We have acquired a Panasonic GPKR402 video camera. This is extremely clear and when used with a 6 mm lens gives a 10.2 ft wide view from 10 feet away. This is ideal for the physical set up and position of the camera. We have shot preliminary film and MIEMSS media personnel (Jim Brown Andy Trohanis) have scrambled images. We wish to scramble the face of the patient so that we can avoid getting patient consent. This will greatly simplify the logistics of filming. We have discussed this with the Institutional Review Board Chairman and it seems likely that this will be acceptable to the IRB. The scrambling was successfully achieved even when the subject was moving and turning.

We are presently comparing specifications of several cameras. We will purchase one more Panasonic GPKR402 but may go with a less sophisticated type of camera for the other two locations.

Personnel and Administrative matters

Xun Luo replaces Jason Ho on the ONR funding at the same % effort and salary. Mr. Luo has a BS in computer science, an MS in electrical engineering and is completing a PhD with major in computer science and minor in communications. He has worked with the PI for the past 3 years and is familiar with the project and Mr. Ho's input. Mr. Ho unfortunately left to go into industry at a far higher salary. We believe Mr. Luo is an equivalent replacement.

Experimental Psychology GRA. This position is presently being advertised at the University of Maryland, College Park, Baltimore County and at Baltimore campuses. Since no video taping of real trauma admissions will take place until September we do no anticipate filling this position until then, especially since it is only funded at a 25% rate for the first year.

We are considering applying for a 2nd GRA under the initiative distributed from Dr. Chipman's office titled "Augmentation Awards for Science and Engineering Research Training." Two other trauma centers at the University of Pittsburgh (Nicholas Bircher, M.D., Associate Director, International Resuscitation Research Center) and Stanford University (David Gaba, M.D.) are also intending to apply for GRA funding through this initiative as off-site collaborating institutions with this grant.

Subcontract. A subcontract was negotiated and signed between the University of Maryland and Dr. Richard Horst, President of Man-Made Systems Inc., to complete the work as described in the original grant application.

Publications

1) The attached abstract titled "Decision Trees for Trauma Anesthesia" has been accepted for presentation at the Computers in Anesthesia XII and will be published in the International Journal of Clinical Monitoring and Computing.

2) Hypotension in the Acutely Traumatized Patient In Decision Making in Anesthesiology, 2nd Edition Ed Bready LL, Smith RB, B.C. Decker Toronto. In Press.

Appendix I

Decision Trees

Publications

1) Abstract titled "Decision Trees for Trauma Anesthesia"

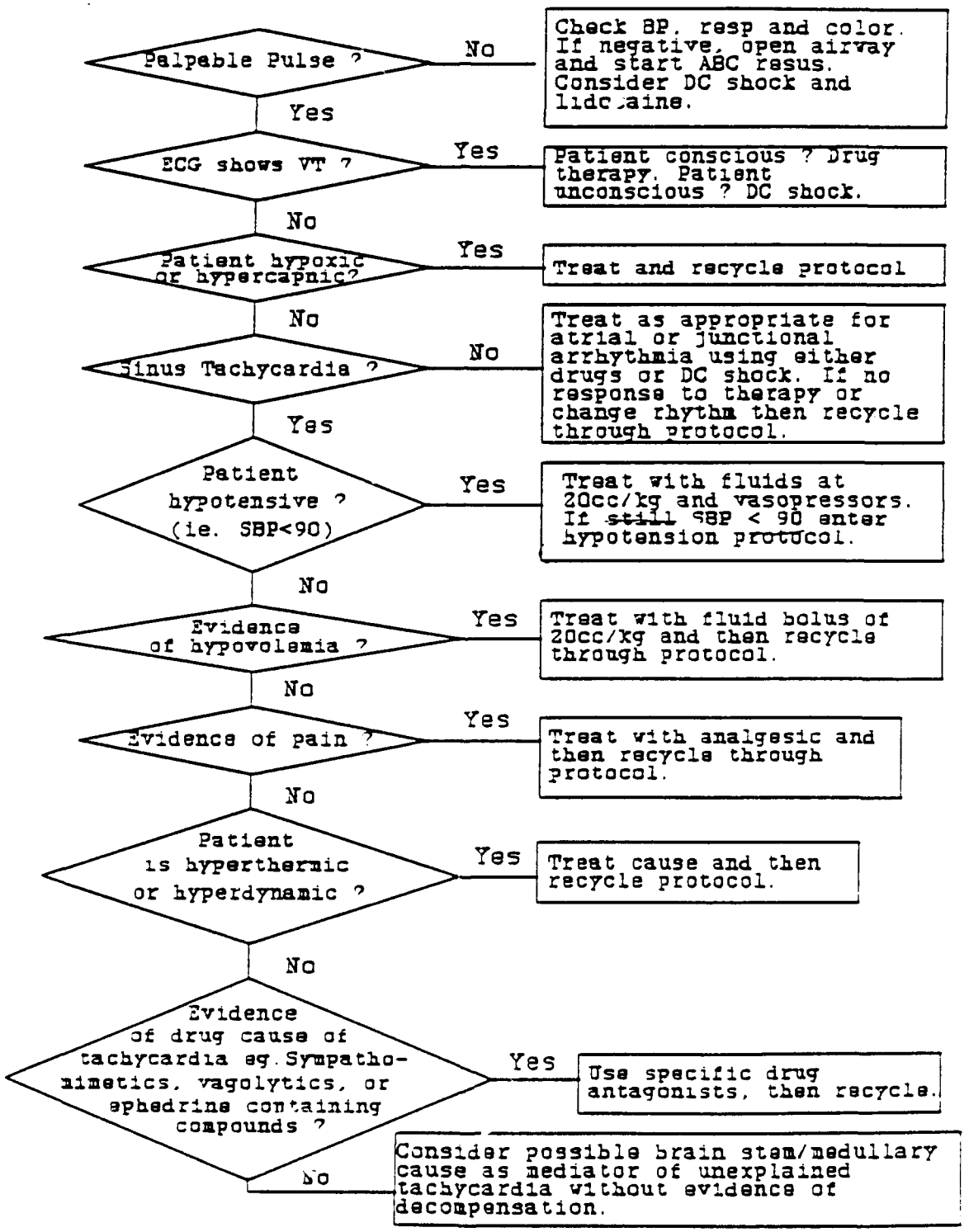
2) Hypotension in the Acutely Traumatized Patient In Decision Making in Anesthesiology

Appendix II

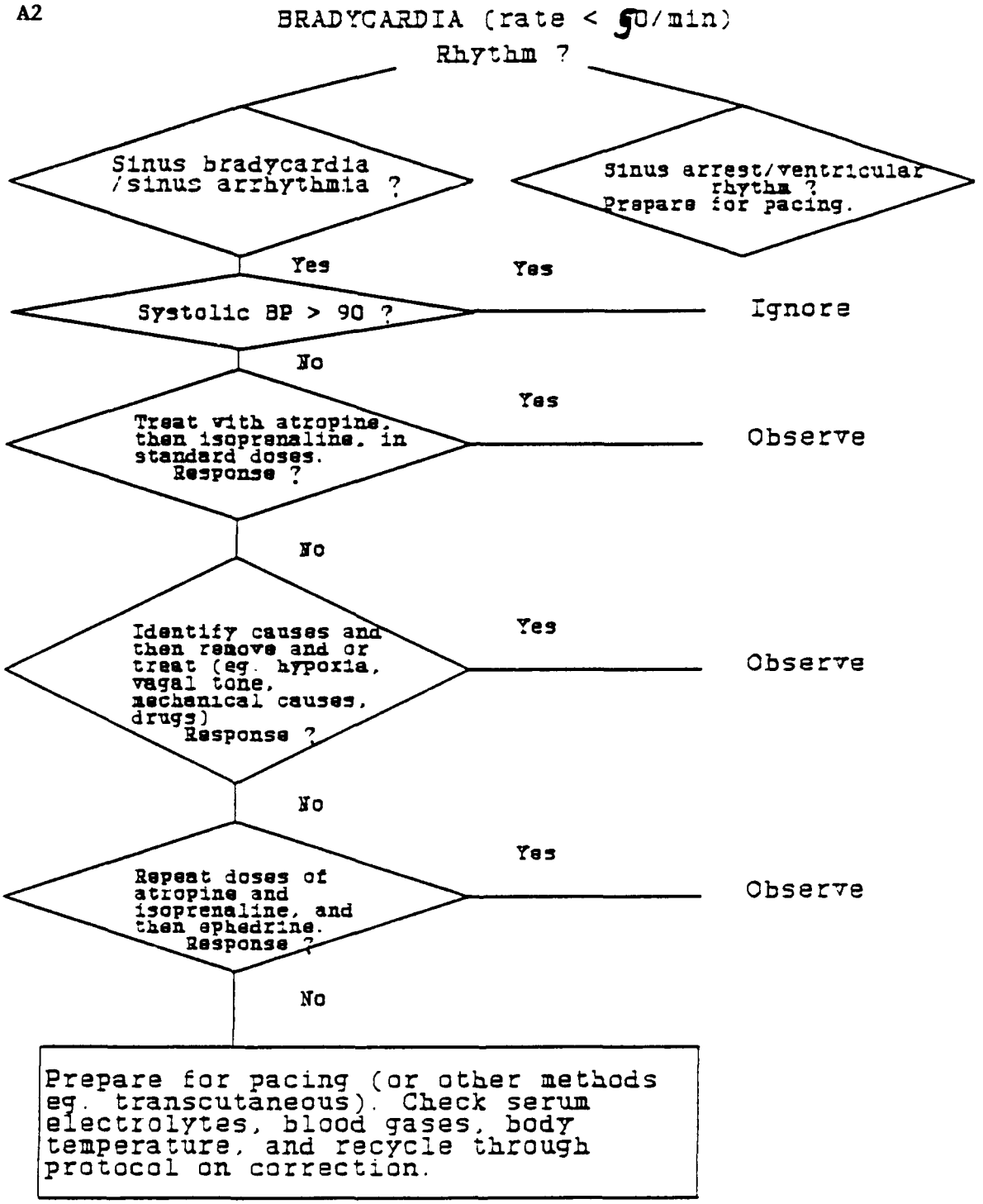
OCS Tools Software Specifications

Appendix I

A1 TACHYCARDIA (rate > 100/min)



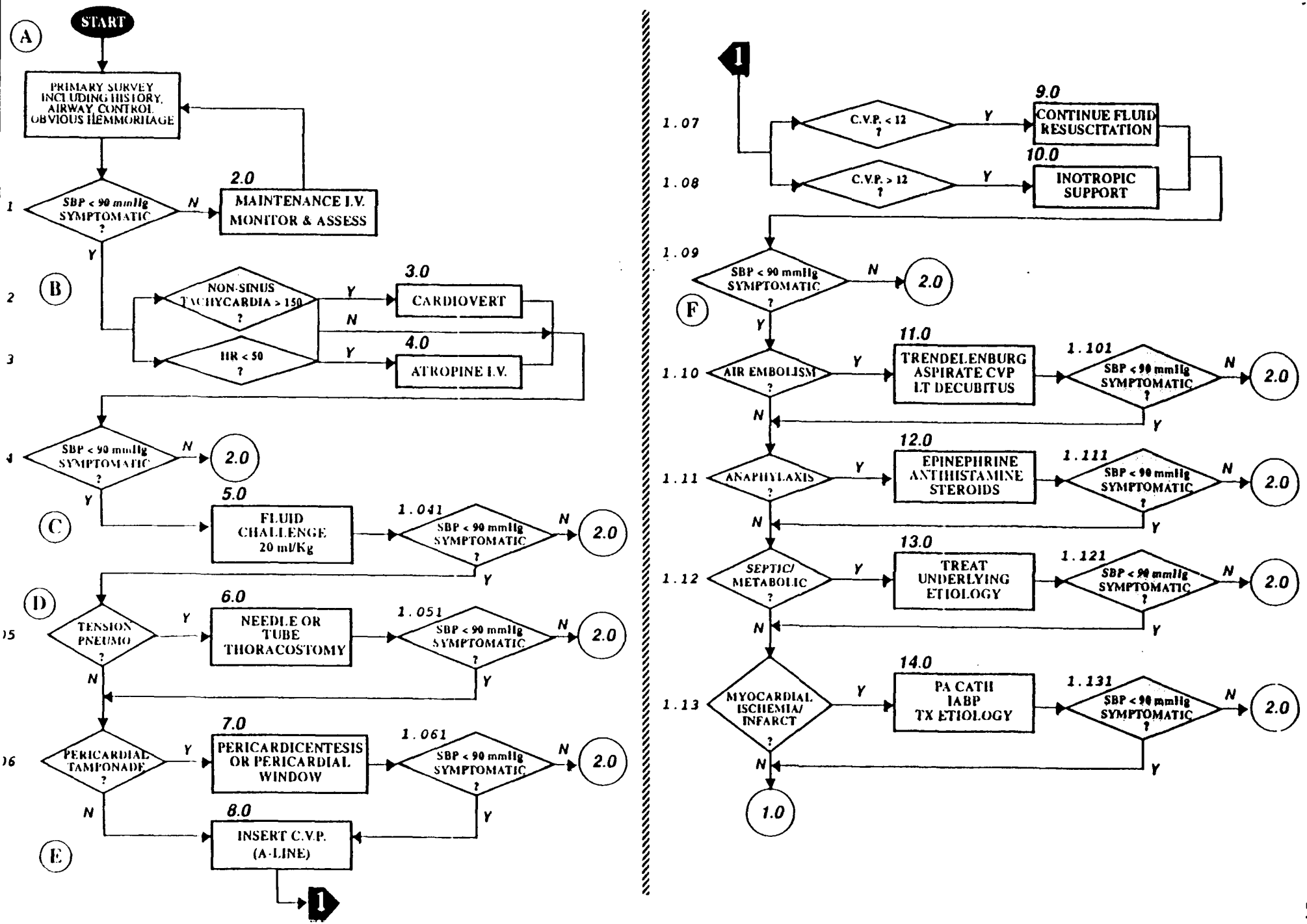
A2



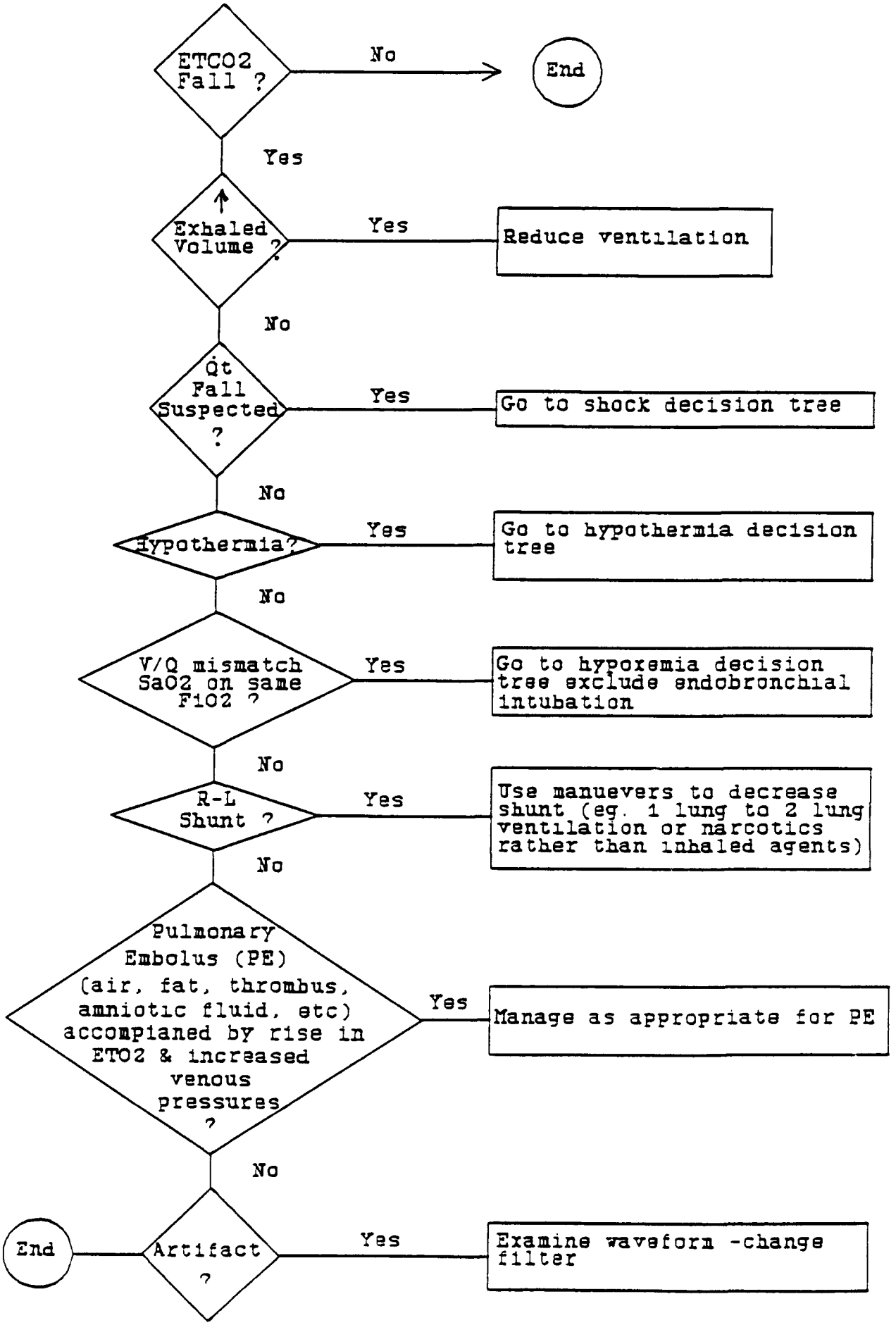
Mode of pacing may depend on type of arrhythmia. For supraventricular disorders, consider A/V sequential, and for ventricular, consider VV pacing.

A3

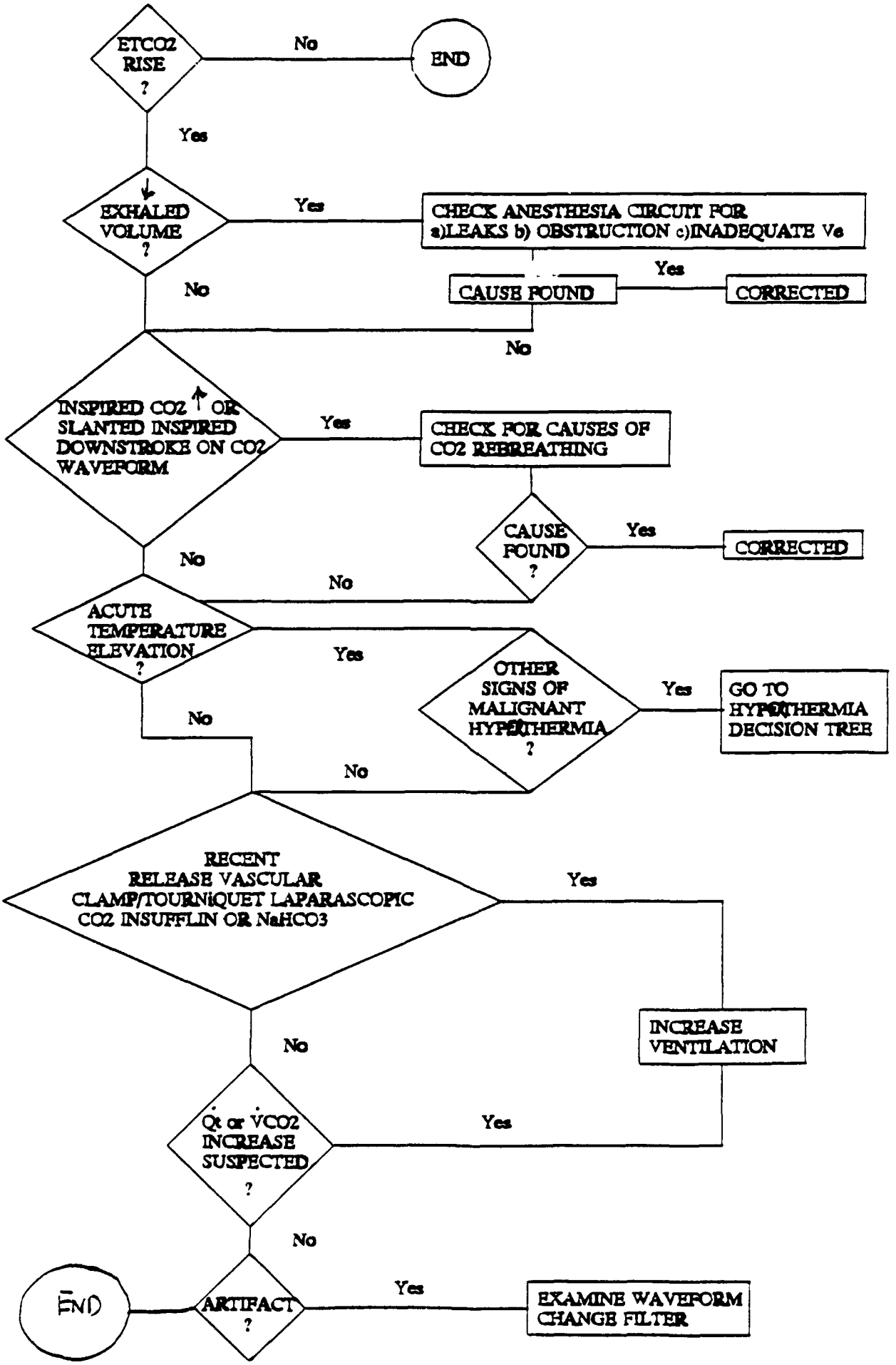
HYPOTENSION IN THE ACUTE TRAUMA PATIENT



A4 DECISION TREE FOR DECREASE IN ETCO2

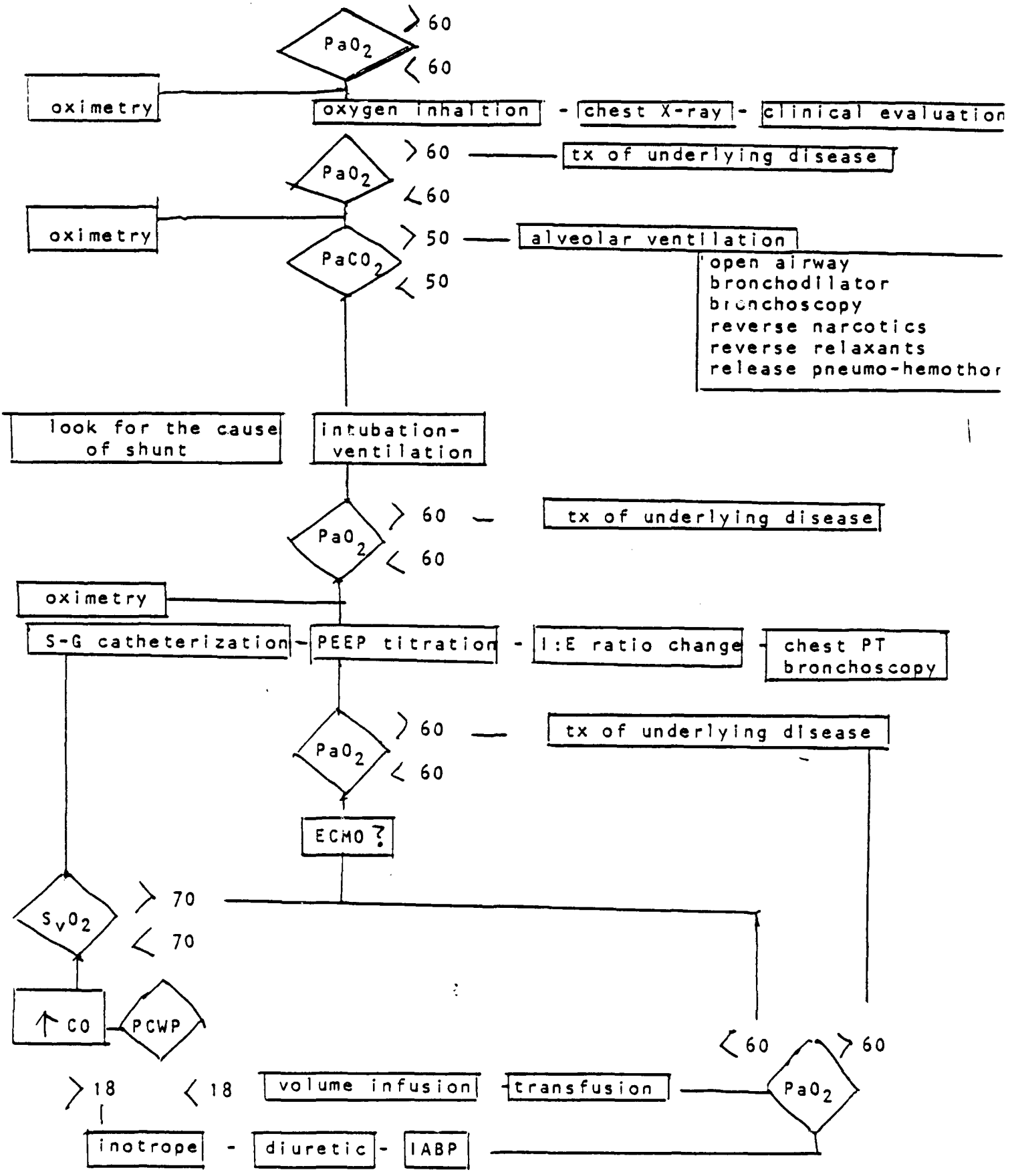


DECISION TREE FOR RISE IN ETCO2



A6

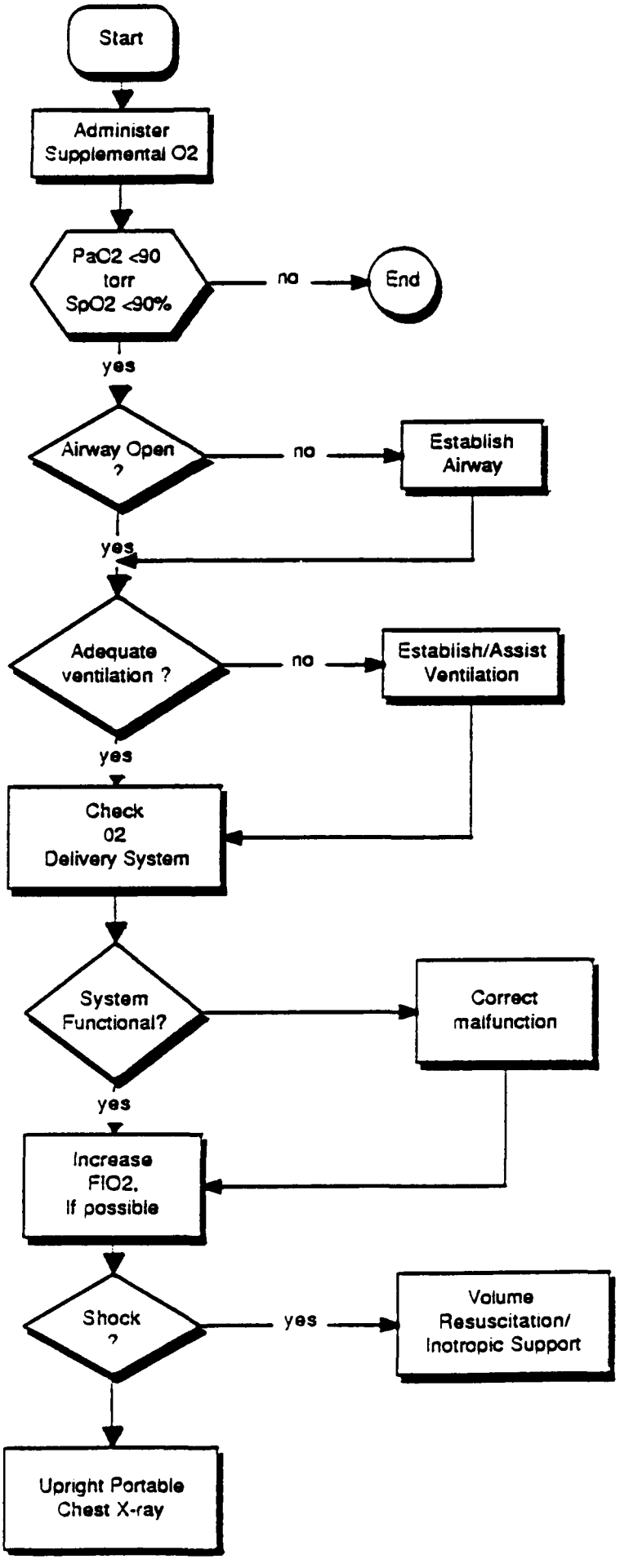
HYPOXEMIA

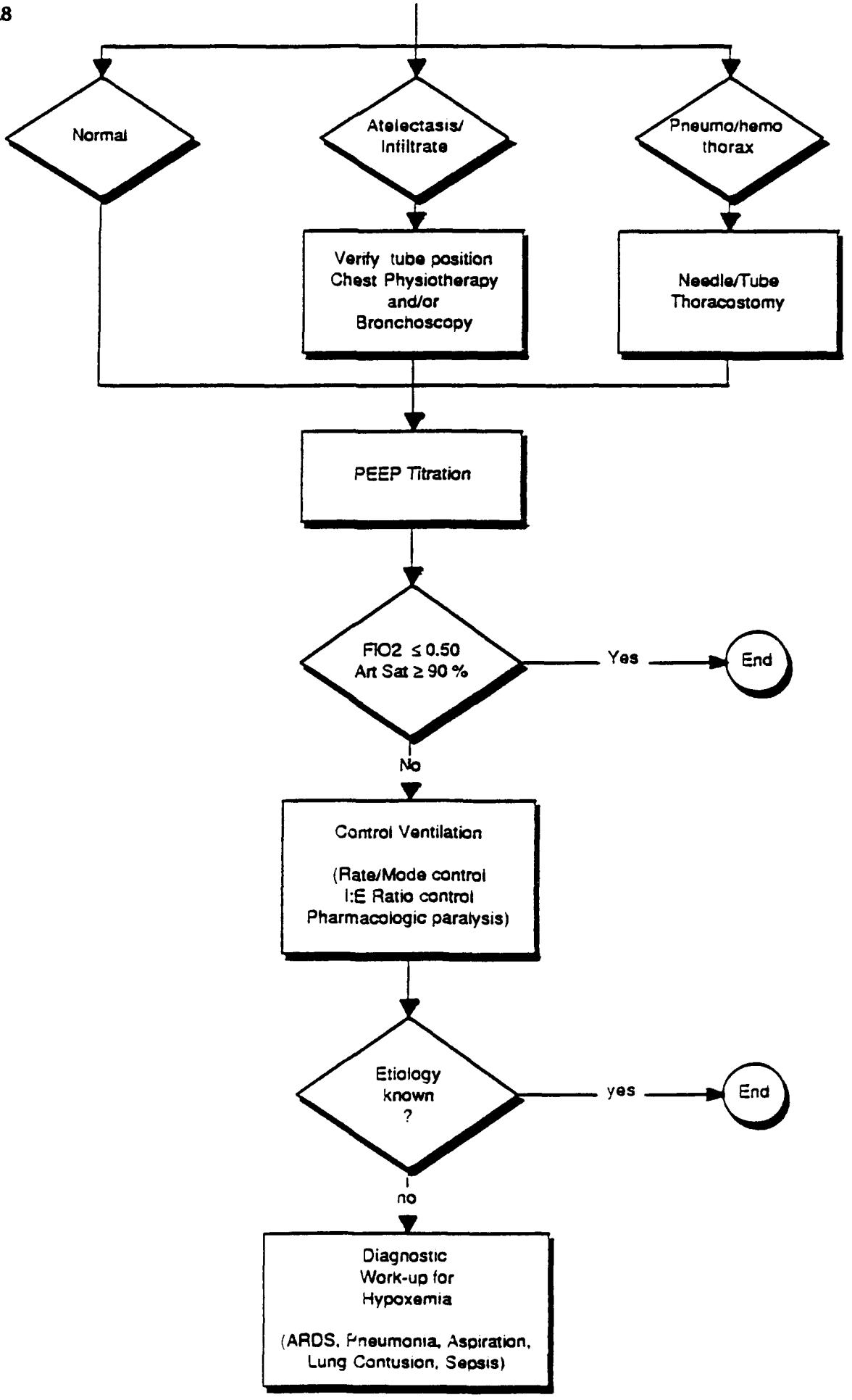


Hypoxemia Algorythm

Version 2.0: 2/91

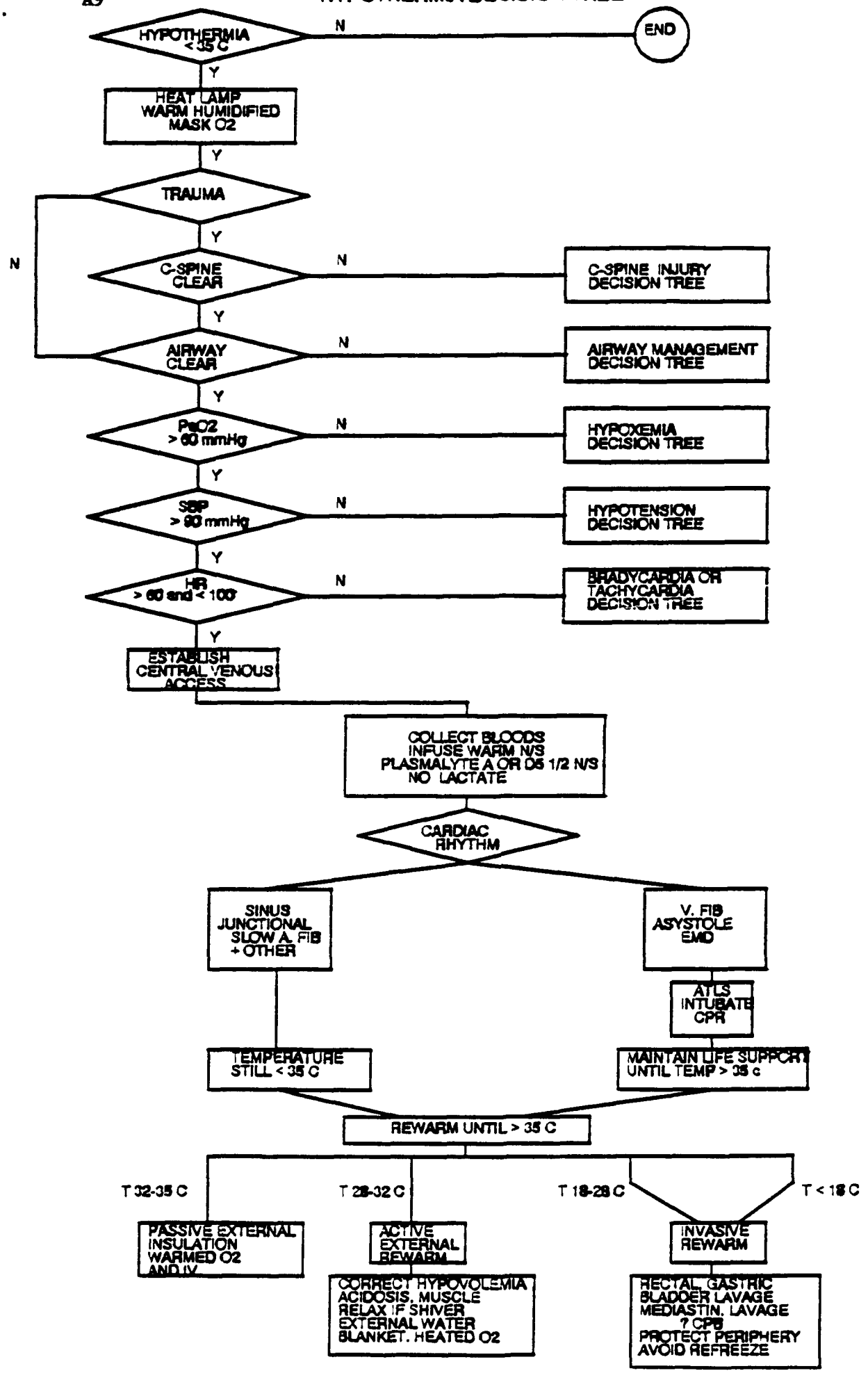
K. GEROLD




Normal
Atelectasis/ Infiltrate
Pneumo/hemo thorax
Verify tube position
Chest Physiotherapy
and/or
Bronchoscopy
Needle/Tube Thoracostomy
PEEP Titration
FIO2 ≤ 0.50
Art Sat ≥ 90 %
Yes
End
No
Control Ventilation
(Rate/Mode control
I:E Ratio control
Pharmacologic paralysis)
Etiology known ?
yes
End
no
Diagnostic Work-up for Hypoxemia
(ARDS, Pneumonia, Aspiration, Lung Contusion, Sepsis)

A9

HYPOTHERMIA DECISION TREE

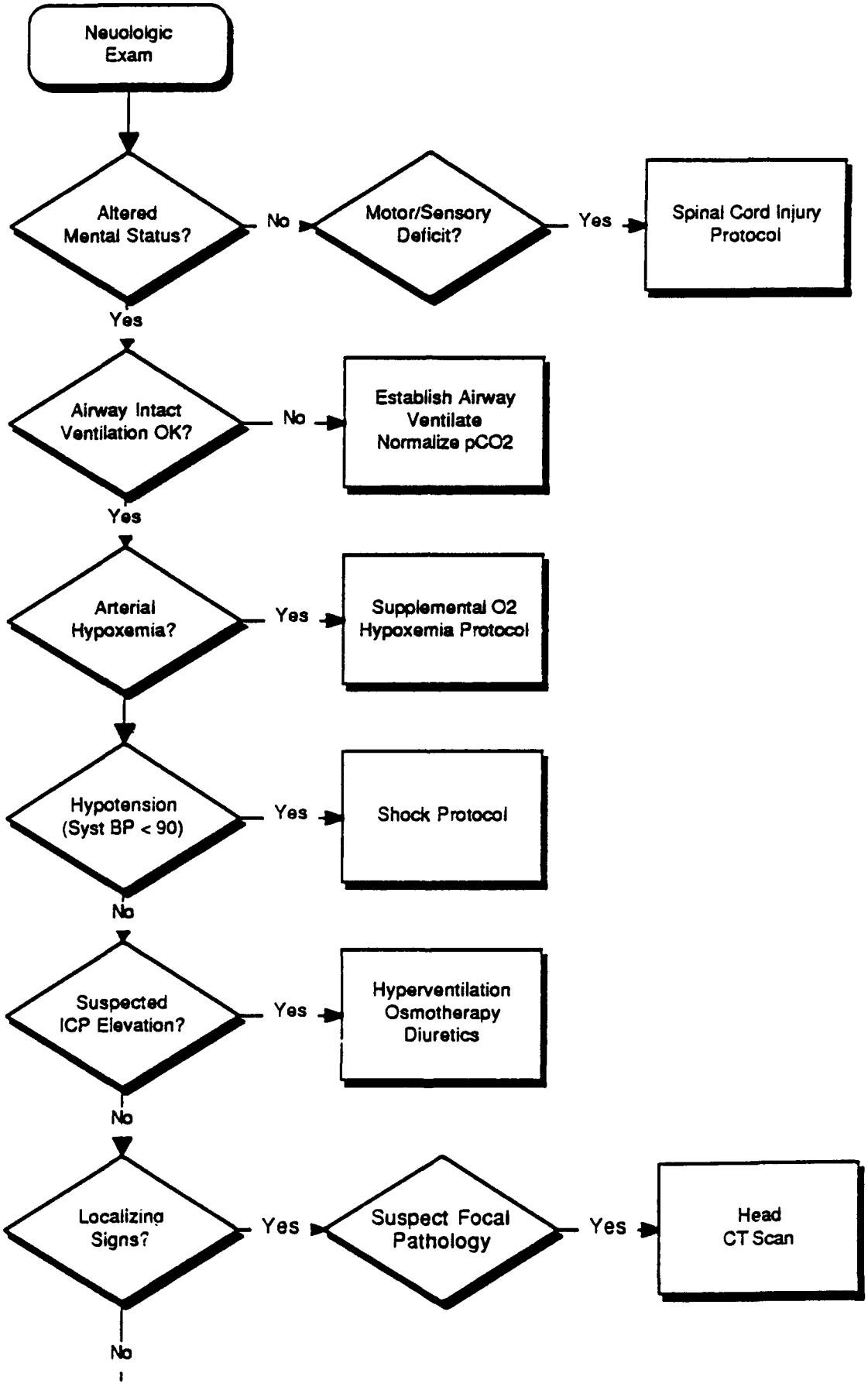


A10

Neurologic Exam Flow v1.0

7/25/91

K. Gerold



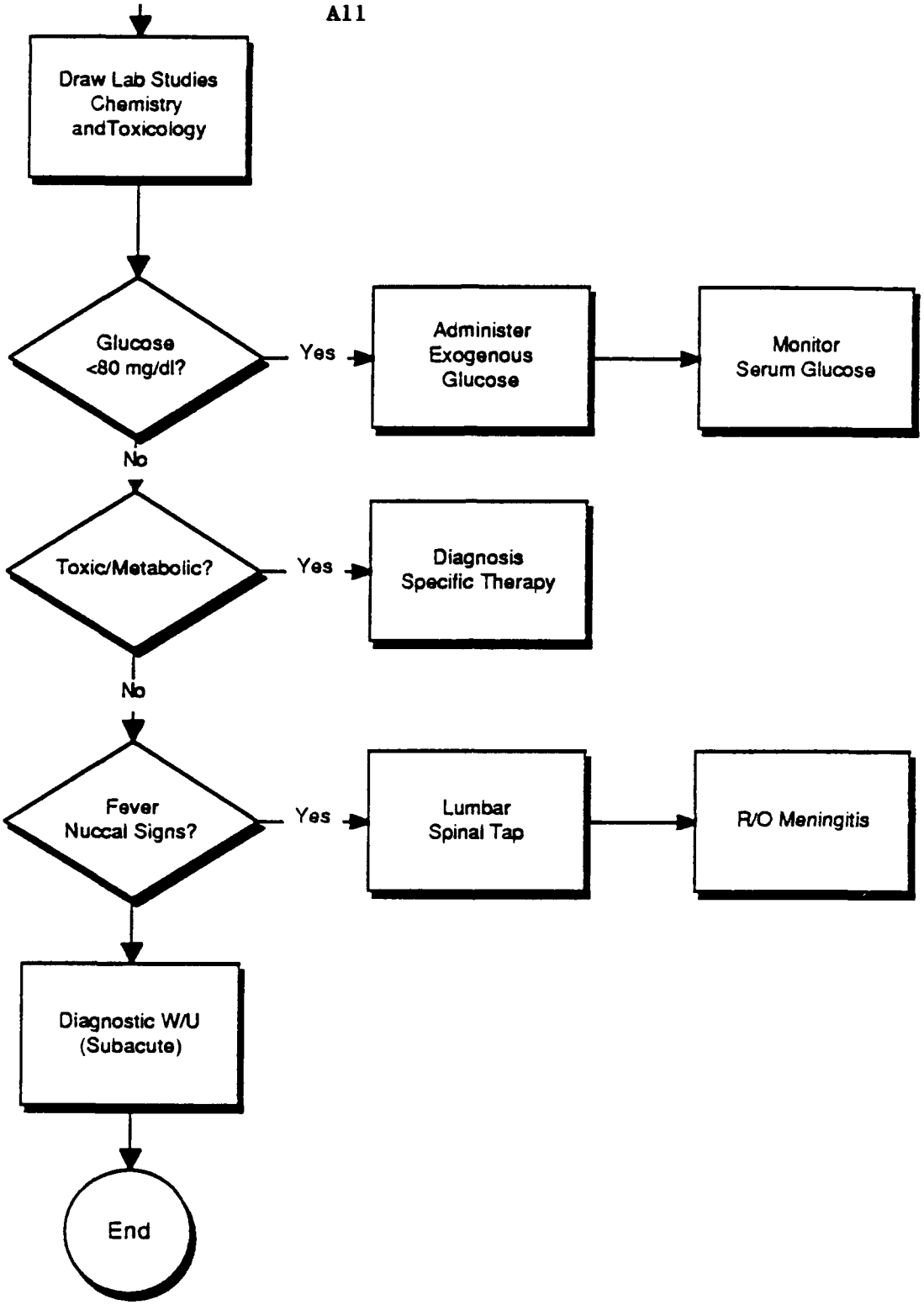
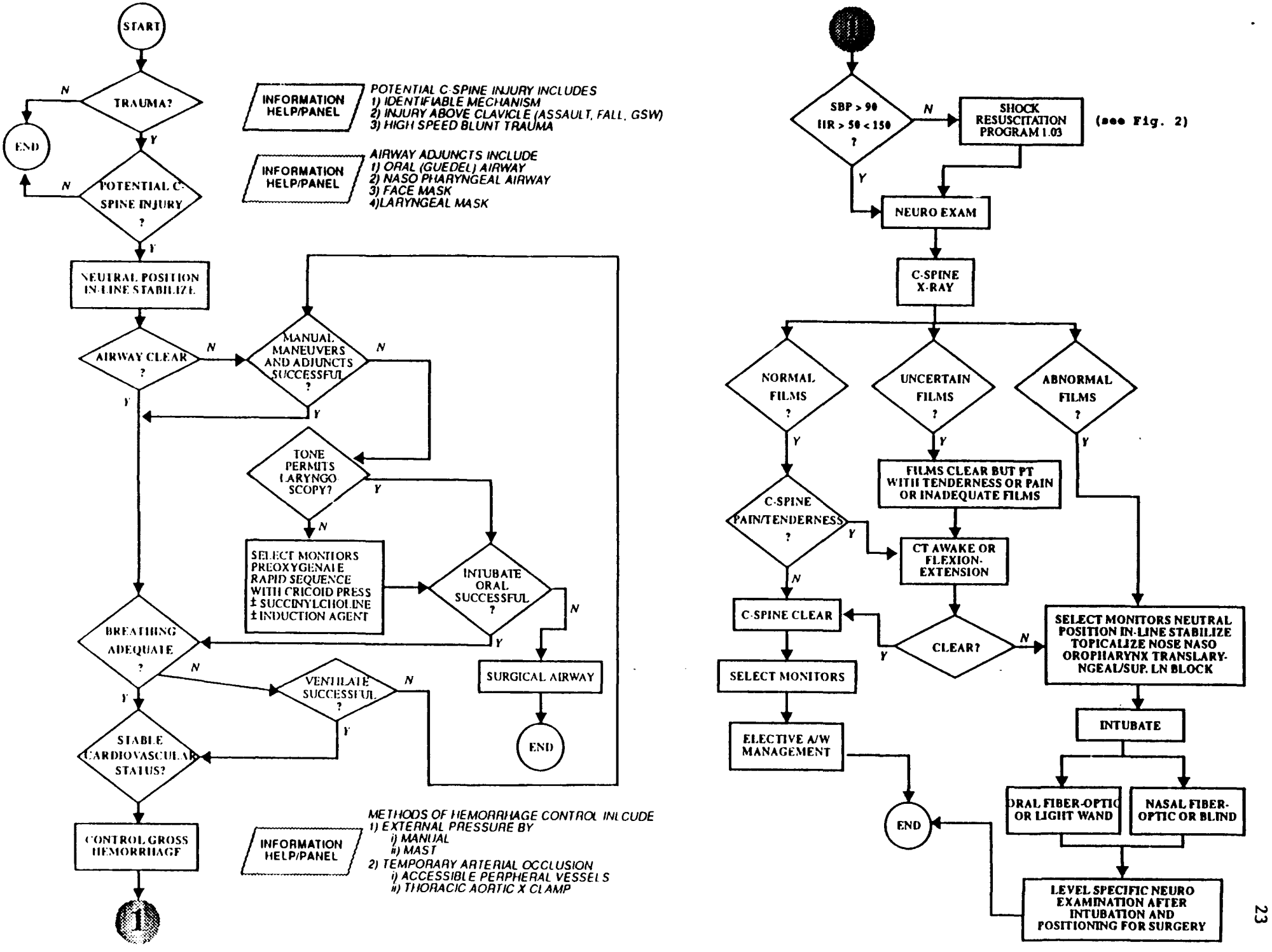
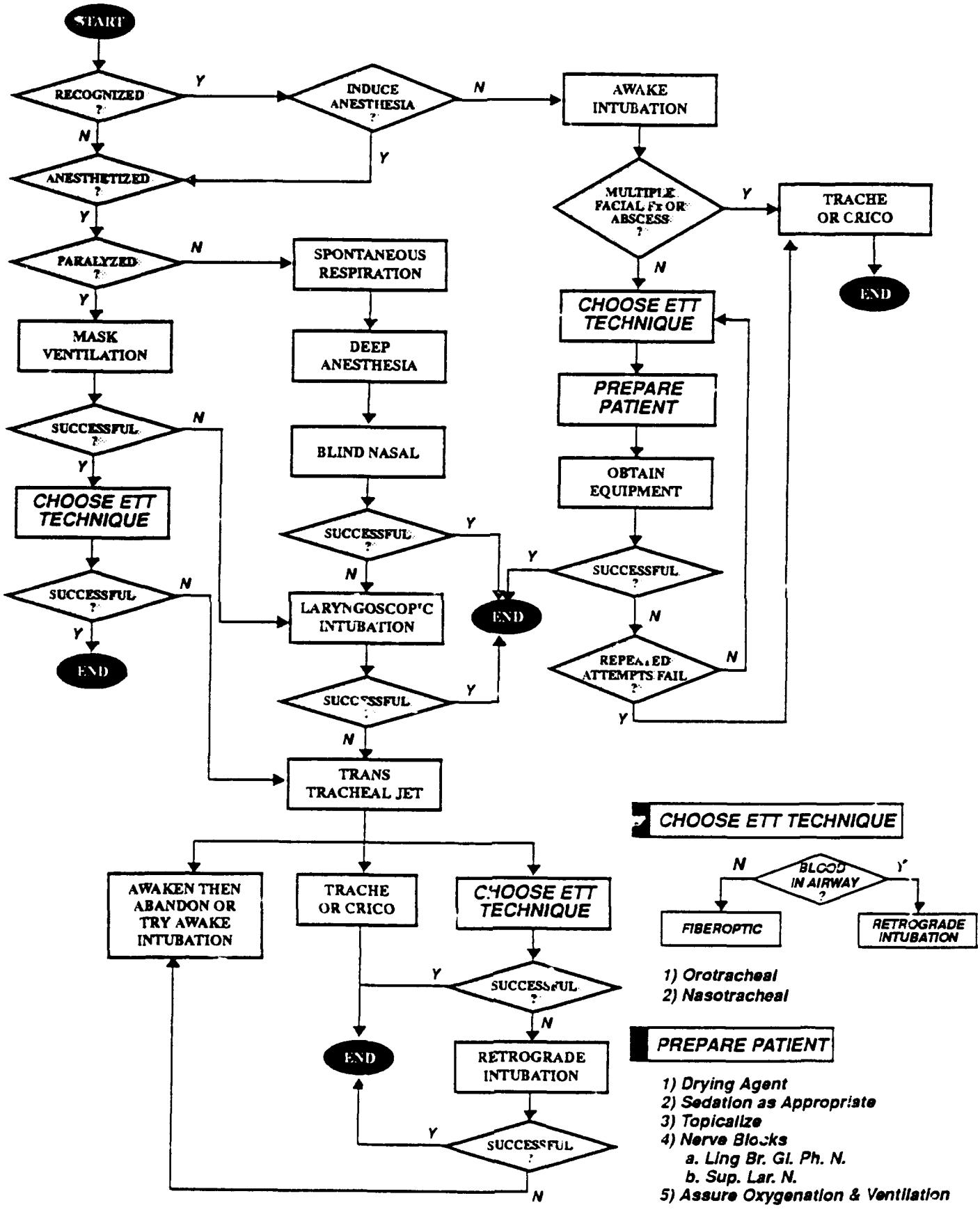

Draw Lab Studies
Chemistry
andToxicology
Glucose
<80 mg/dl?
Yes
Administer
Exogenous
Glucose
Monitor
Serum Glucose
No
Toxic/Metabolic?
Yes
Diagnosis
Specific Therapy
No
Fever
Nuccal Signs?
Yes
Lumbar
Spinal Tap
R/O Meningitis
Diagnostic W/U
(Subacute)
End

Fig. 1 ACUTE CERVICAL SPINE INJURY AIRWAY MANAGEMENT ALGORITHM DEVELOPED BY LOTAS GROUP



A13

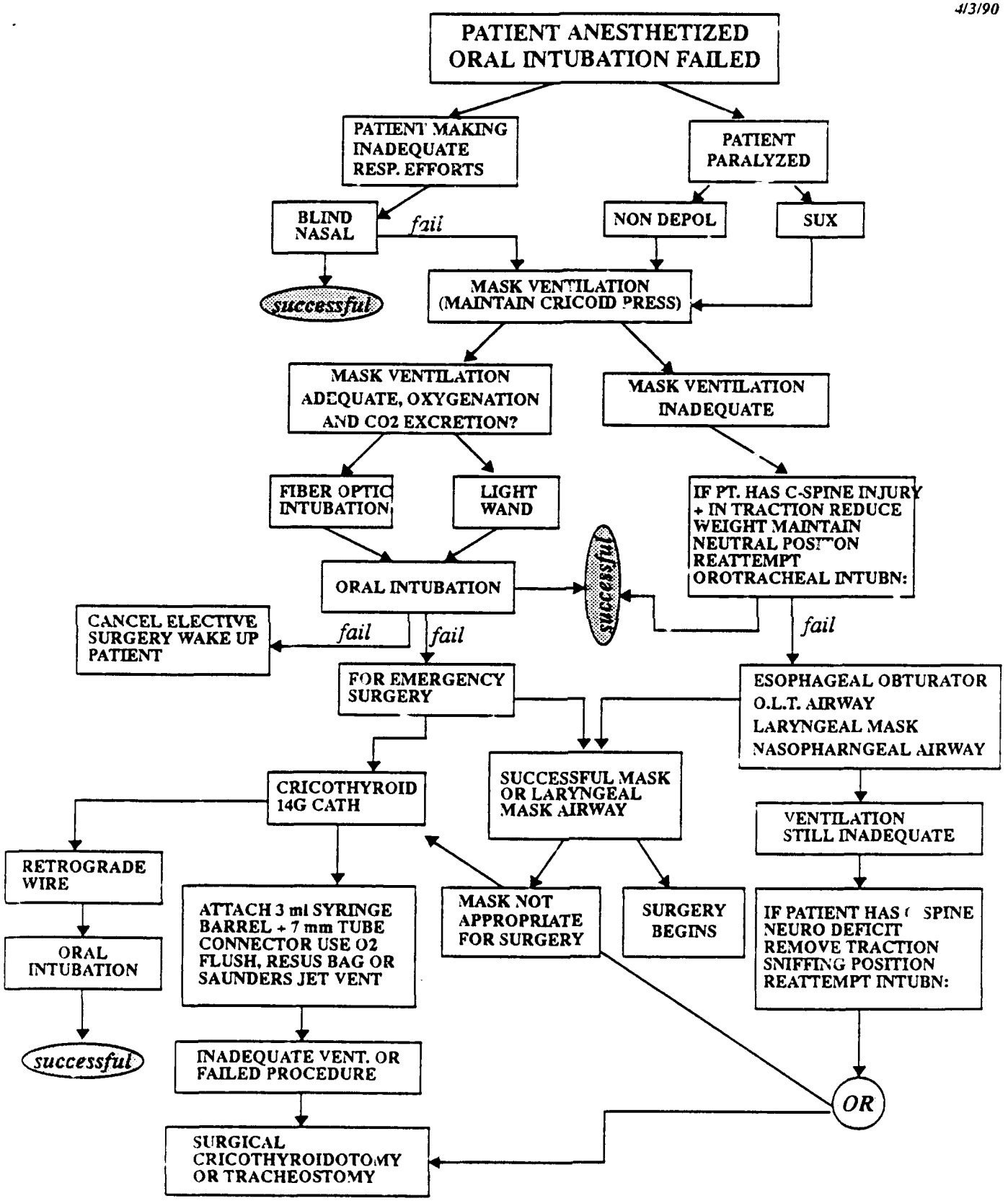
MANAGEMENT OF THE DIFFICULT AIRWAY



A14

STRATEGIES FOR FAILED INTUBATION

C.F. MACKENZIE
4/3/90



Decision Trees for Trauma Anesthesia

Colin Mackenzie, Alasdair Dow, Ken Dauphinee, Kevin Gerold, Richard Horst*, Baekhyo Shin, Chris Grande, Mike Parr, Brian McAlary, Jerry Nolan, William Bernhard (LOTAS group)
Departments of Anesthesiology, Maryland Institute for Emergency Medical Services Systems (MIEMSS) and University of Maryland and Man-Made Systems Corporation*, Baltimore Maryland.

A Level One Trauma Anesthesia Simulation (LOTAS) group has met monthly for 1 1/2 years to produce decision trees for correction of abnormalities in physiological variables monitored during trauma anesthesia. These variables and the decision trees produced include bradycardia, tachycardia, hypoxemia, ↑ end tidal CO_2 ($ETCO_2$), ↓ $ETCO_2$, hypotension (see fig overleaf), hypertension, hyperthermia, hypothermia. One object of the study is to examine with videotaping performance of trauma anesthesiologists during resuscitation and anesthesia in the real-life setting of MIEMSS, a level one trauma center. Videoanalysis of actual interventions used in the real life setting to normalize out of range physiological variables will be used to validate the reasonableness of the intervention identified in the decision tree.

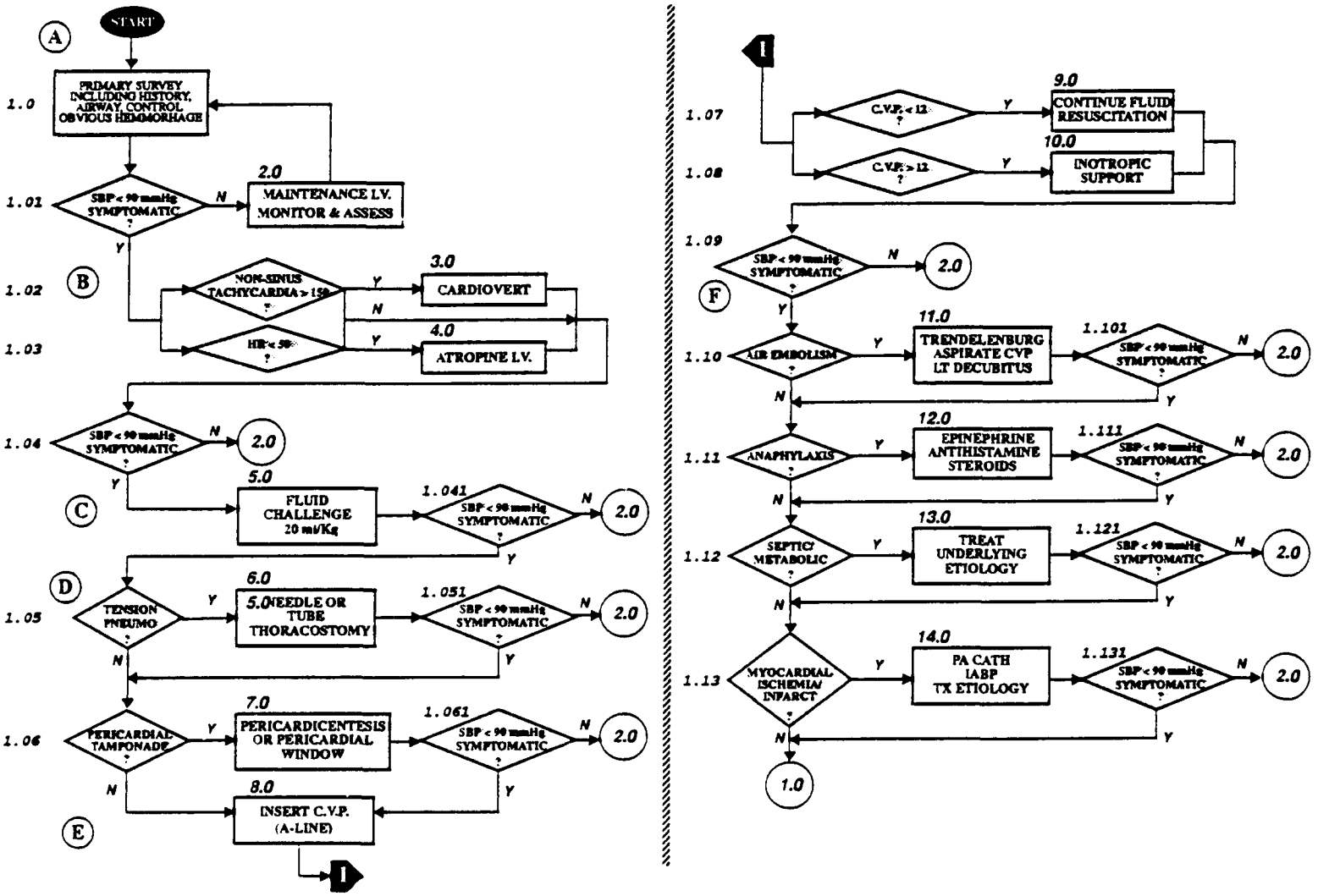
Video cameras interfaced with continuously displayed physiological variables will enable subsequent videoanalysis by anesthesiologists and experimental psychologists. In this 3-year study, we will construct a task network model using MicroSAINT, a human factors simulation package, to describe decisions made during resuscitation in the admitting area and operating rooms at MIEMSS. Establishment of mean and standard deviation of execution times of tasks used to correct abnormal variables will enable MicroSAINT to identify points in the decision tree where changes in management may expedite return of a given variable to normality.

We intend to identify stressors affecting performance of anesthesiologists such as information uncertainty, workload, team interactions, fatigue, uncertainty and time constraints. We intend to improve the decision trees, identify training strategies and objectively document the

stressors that affect performance. In addition we will examine efficiencies that some anesthesiologists use to achieve shorter reversal of unfavorable physiological variables, or to reduce workload or gain from favorable team interactions.

Funded by grant # N00014-91-J-1540 from the Office of Naval Research.

HYPOTENSION IN THE ACUTE TRAUMA PATIENT



HYPOTENSION IN THE ACUTELY TRAUMATIZED PATIENT

Kevin B. Gerold, D.O.

Kenneth Dauphinee, M.D.

Colin F. Mackenzie, M.D.

and the LOTAS Group.

Acute symptomatic hypotension in the acutely traumatized patient signals a potentially life-threatening condition requiring immediate intervention. Initial resuscitative efforts are conducted in a systematic manner; directed toward reversing the physiologic disturbance, even when the definitive diagnosis is unknown. Actions at each level of the algorithm must occur to insure that the specific etiology is addressed and corrected before proceeding on to the next level.

Hypotension is arbitrarily defined as a systolic blood pressure less than 90 torr with clinical manifestations of inadequate end-organ perfusion. Clinical findings suggestive of end-organ hypoperfusion include alterations in mental status, decreased urine volumes, myocardial ischemia on EKG, and peripheral vasoconstriction.

A Initial priorities common to all resuscitative algorithms insure airway patency while stabilizing the cervical spine, confirm the adequacy of ventilation, and control obvious gross hemorrhage. These ABC's should also include, to the extent possible, a basic neurologic examination (mental status, pupillary response, and movement of extremities), a brief history relating events surrounding the injury, and a basic past

medical history including allergies and medications. Those involved in the resuscitation must be cautious not to overlook less obvious signs of serious pathology that can occur in the presence of more evident, though non-life threatening injuries.

B Disturbances in cardiac rate and rhythm may contribute to symptomatic hypotension in the traumatized patient. Brady-dysrhythmias may occur with severe head or cervical spinal cord injury. When associated with hypotension, the heart rate should be accelerated using atropine, isuprel, or external pacing. Non-sinus tachy-dysrhythmias (uncontrolled atrial fibrillation, atrial flutter, ventricular tachycardia or ventricular fibrillation) are rarely seen in trauma patients, but may cause or contribute to hypotension. Diagnosis is made by the early application of EKG monitoring. Correction of the tachy-dysrhythmias should occur without delay using electrical or pharmacologic cardioversion using specific guidelines described elsewhere.

C Hypovolemia is assessed and initially treated by administering a rapid fluid challenge. Patients should receive 20-40 ml/kg of a crystalloid infusion delivered at a rate of at least 50 ml/min. Colloid alone or combinations of colloid or crystalloid may be substituted for intravascular volume expansion if so desired.

D Persistent hypotension in the presence of an adequate intravascular volume requires the exclusion of etiologies that reduce cardiac output by mechanically obstructing venous return.

E Central venous catheterization can be performed rapidly and with relative ease during a resuscitative effort. Monitoring right atrial pressures enables the assessment of reserve cardiac function by observing the pressure response to fluid challenge. A pulmonary artery catheter does not usually provide additional clinically useful information during the initial phases of resuscitation. A normal or low (< 12 mm Hg) right atrial pressure in response to a continued rapid fluid challenge suggests intravascular volume depletion due to ongoing hemorrhage or increased vascular capacitance. Blood products should be administered when the patient fails to respond to an adequate crystalloid and/or colloid fluid challenge. Type and cross-matched packed red blood cells are preferred, but type specific or type-O blood are acceptable alternatives. O-negative blood should be administered, when necessary, to female patients of child bearing age. The need for fresh frozen plasma and platelets should be anticipated early, and administered when blood loss appears to exceed 40% of the circulating blood volume (> 2000 ml).

Inotropic support is started when further elevations in right atrial pressure (> 12 mm Hg) fail to generate increases in blood pressure or reverse signs of shock.

F It must be remembered that traumatic injury may occur in association with medical illness. These etiologies must be included as uncommon, but potential causes of ongoing hypotension in the acute trauma patient. Initial treatment of these etiologies is supportive, using volume expansion and inotropic support while definitive diagnostic and therapeutic measures proceed.

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1. Textbook of Advanced Cardiac Life Support. Dallas: American Heart Association, National Center, 1987.

2. Advanced Trauma Life Support. Chicago: American College of Surgeons, 1988.

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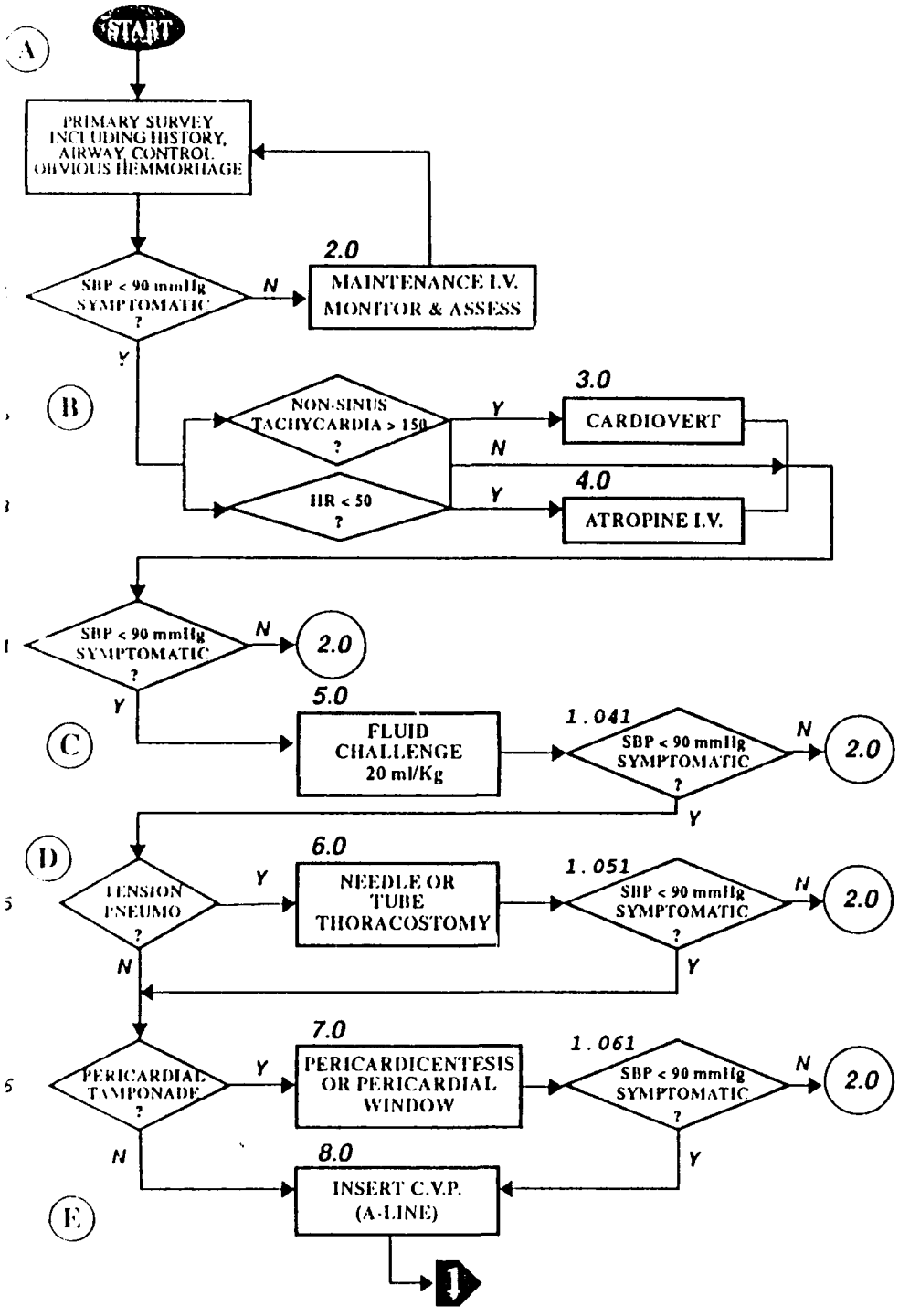
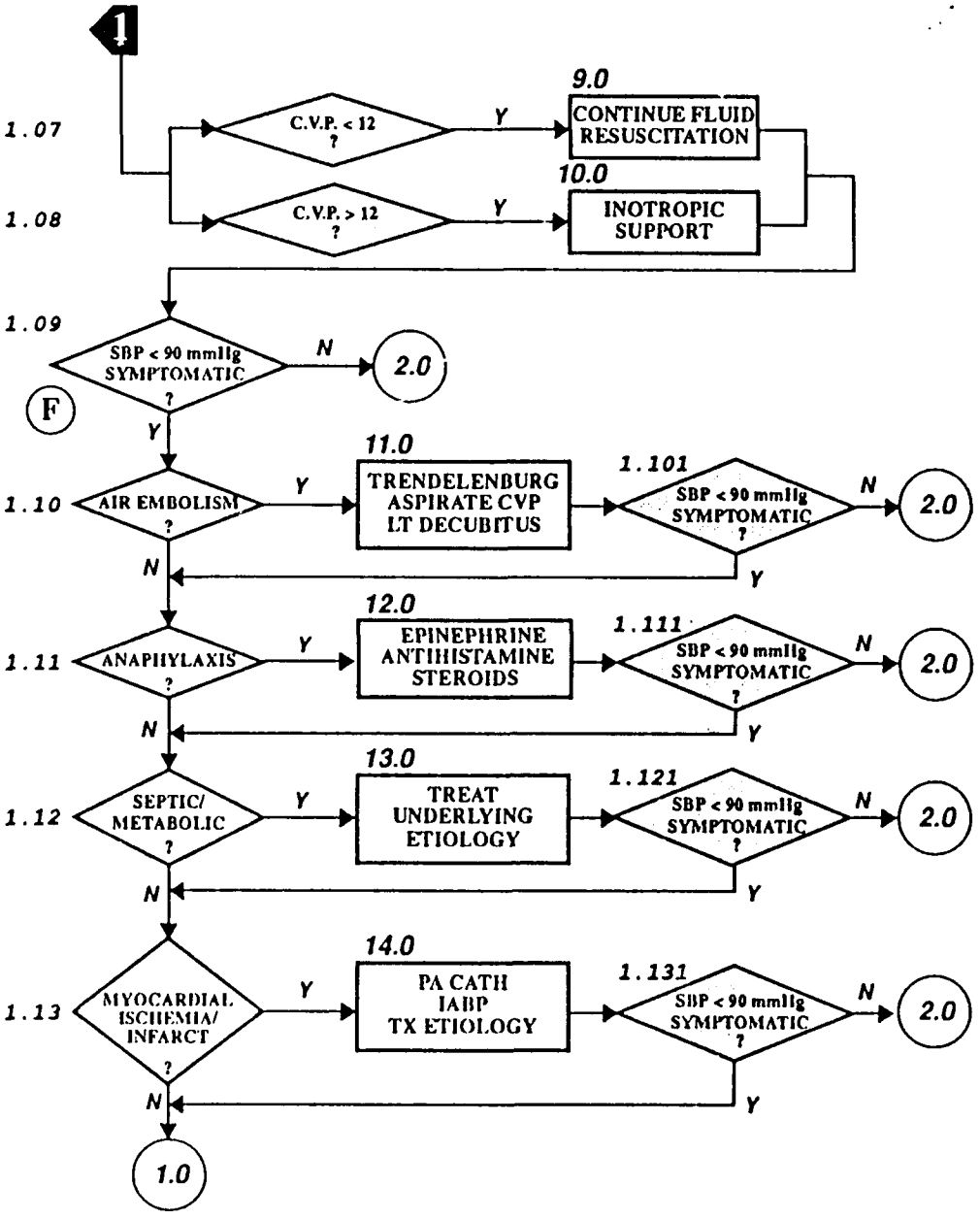
4. Moore, E. E. *Resuscitation and evaluation of the injured patient*, in Zuidema, G. D., Rutherford, R. B., and Ballinger, W. F. (eds.), The Management of Trauma, 4th ed. Philadelphia: W. B. Saunders Co., 1985. pp 1-26.

5. Schwab, C. W., Ross, S. E. *Exsanguination*, in Maull, K. I. (ed.), Advances in Trauma, Vol. 1. Chicago: Yearbook Medical Publishers, 1986. pp 105-117.

HYPOTENSION IN THE ACUTE TRAUMA PATIENT





Appendix II

OBSERVATIONAL CODING SYSTEM TOOLS (tm)

The Observational Coding System Tools (OCS TOOLS (tm)) integrate software and hardware for observational data collection, editing, records management, and data analysis. The OCS TOOLS can improve the reliability and efficiency of observational data collection procedures.

The OCS TOOLS are a modular system of components, making possible a wide variety of customized data collection configurations. Purchase only the items required for specific data collection and analysis projects. OCS TOOLS will operate on IBM-PC, XT, AT, PS/2 or 100% compatible machines.

Three types of basic systems (OCS-LIVE, OCS-FRAME, and OCS-VCR) are available to meet specific project needs. Each can be enhanced by a number of additional software and hardware options.

UNIVERSAL FEATURES

PC Serves as Event Recorder

All OCS Systems allow the user to enter codes directly into the computer and can be used to code live events and events recorded on videotape. Codes are entered at the computer's keyboard and may be up to 10 characters long. Additional descriptive information may be added for a code during or after a coding session. Coding may be done in a continuous fashion for discreet events or by using start/stop codes for overlapping events.

Automatic Timestamping

The computer automatically records the time at which the codes were entered. However, the source of time is different for each type of system. OCS-LIVE records time from the CPU's internal clock. OCS-FRAME allows the operator to scroll time forward or backward in standardized increments (increments vary according to video format), matching time to that recorded on a video frame. This time is automatically entered when the operator enters a code. OCS-VCR automatically reads time from each video frame, allowing the computer to remain synchronized with the videotape even after rewinding or fast forwarding.

Dataset Editing and Merging Functions

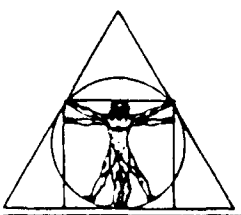
Each of the data collection tools includes an optimized interface for collecting event data. Datasets may be edited at any time. A coding session Mini-Editor can be used to review and edit codes during coding sessions. The full editing software may be used to review and edit datasets which have been collected and/or stored. A data collection audit trail, used to mark outdated codes, is available on all OCS-VCR systems. Datasets generated by any data collection tool can be merged together to create larger datasets.

Easy to Use Menu Driven Software and Manual

All OCS Tools are easy to learn and operate. Screen menus offer a choice of actions. Knowledge of operating each software system is highly transferable to other OCS software, increasing the speed with which learning new systems occurs. Screen prompts for hardware setup procedures are included for those systems which involve resetting hardware for coding or playback. A comprehensive user's manual details software operation and hardware setup procedures.

System Administration Functions

Each data collection tool includes a Project Administration System (**ADMIN**) which allows a project manager to select which hardware will be operational, which timecode and duration format will appear on data printouts, whether or not rewind markers are used, and whether NTSC or PAL videotape is being used.



The project administrator can also assign log-on rights to coders, limit any coder's access to the data, specify path and directory limits, and specify operator reaction time (which can be calculated with other tool components).

Dataset Verification and Observer Training Functions

All OCS-VCR systems include a Dataset Playback System (**PLAYBACK**), which allows the user to watch a videotape while the computer provides information about which codes and descriptions have occurred. An optional Dataset Agreement System (**AGREE**) allows project administrators to compare two coding sessions of the same observation, to determine where coders agreed and where they disagreed.

Dataset Analysis Functions

Each data collection tool includes the Summary Statistics System (**SUMSTAT**), which calculates frequency and duration of specified events (including total frequency, total duration, mean duration, minimum duration, maximum duration, and standard deviation), and prepares data for further analysis.

A number of other analysis tools are also available for any of the data collection systems. These include an Interval Analysis System (**INTERVAL**), Time Series Comparison System (**TSC**), Duration Analysis System (**DURATION**), and Pattern Analysis System (**PATTERN**).

Compatibility

Data collected with the OCS TOOLS may be organized and analyzed using any hardware/software system which will accept ASCII files.

All OCS hardware and software components are completely compatible with system upgrades, and all data gathered with present systems will be compatible with future software updates and with system upgrades.

All upper level systems are completely compatible with and contain all features of lower level systems, making it easy to upgrade to a more sophisticated method of synchronization at a later time.

ADVANTAGES OF THE OCS TOOLS

OCS makes it easy to code

Codes are entered directly into the computer, and automatically timestamped.

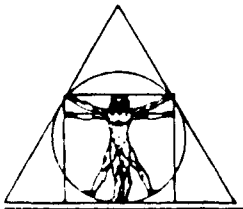
OCS software is optimized to speed the collection of various types of data and adapts to any coding system. Enter codes of different lengths. Codes may be from 1 to 10 characters long. Letters, numbers, and spaces may be part of any code. Upper and lower case letters are differentiated.

Create new codes during a coding session if needed. If an event is not immediately clear, enter a time (by pressing spacebar) and then enter the code when ready. Add descriptive comments to any code at any time. Edit codes at any time—during or after the coding session. Rewind the videotape and recode portions of tape to increase accuracy. Code videotape at the optimal tape speed—normal play speed, slow, freeze-frame, or faster than "play" speed. Change video speeds during a coding session without affecting results.

OCS eliminates common coding errors

Automatic timestamping insures accurate time recording and eliminates transcription errors. Look-away error during live coding in the field is reduced with the easy to use coding system. With video, look-away error can be entirely prevented by using a video-overlay system.

Datafiles can be converted into Reports and checked for common coding errors using **VARIABLE** definitions.



OCS saves time and money

OCS allows accurate results to be entered and checked quickly. Summary Statistics and Interrater Reliability data are immediately available with **SUMSTAT** and **AGREE**. Data is saved directly to disk, eliminating transcription. A dual keyboard system (**OCS-KBD-2**) allows two coders to code one videotape (or live event) simultaneously, dividing the coding task and reducing coding time by half. For Software Usability applications, Keystroke Capture (**OCS-KBD-CAP**) will automatically collect keyboard operations from a second CPU system, without the need for an observer.

OCS is adaptable to large or small research teams

Project administrators can set up a database of users with varying access rights. Coders can be trained to recognize codes using the **PLAYBACK** program, and checked for accuracy using the **AGREE** program. An operator reaction time factor can be assigned to individual coders in order to collect data that is more accurate and similar to data collected at a frame-by-frame rate. This feature saves coding time by allowing operators to code videotape moving at faster speeds.

OCS makes data management easy

Two or more datafiles can be merged.

A VARIABLE file can be used to delimit the information to be analyzed in any datafile. Wild-card characters (*,?) may be used to specify classes or groups of codes.

A file management system included in every software package allows files to be copied or moved to another directory, renamed, sorted, deleted, assigned attributes, or selected according to a parameter, such as file name extension or date, without leaving the system.

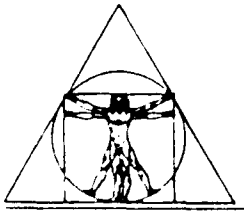
DESCRIPTION OF THE OCS TOOLS

The Observational Coding System is a modular system of software and hardware components. Minimum requirements for each type of system—LIVE, FRAME, and VCR—are listed below. Each system includes data collection software (**OCS**), system administration software (**ADMIN**), records management, editing and reporting tools, a summary statistics software package (**SUMSTAT**), a comprehensive user's manual, and 12 months of software updates, telephone line support, and limited warranty. All OCS-VCR systems also include **PLAYBACK**, a data verification and observer training software tool.

Additional data analysis software is available and is described below. In addition to the video timecode system hardware requirements for OCS-VCR systems, additional multimedia tools and other hardware options are also described below.

GENERAL SOFTWARE FEATURES

The data collection and analysis software described below share several features. One is the **VARIABLE FILE**. A variable file can be created and/or used in any of these packages: **SUMSTAT**, **INTERVAL**, **AGREE**, **DURATION**, and **TSC**. A variable file selects which codes will be analyzed. Select one code, several codes, all codes, or a class of codes using wild card characters (such as "All codes beginning with the letter A = A*"). The variable file also indicates which type of coding was used (continuous for discrete events or start/stop for overlapping events). One dataset may be analyzed with multiple variable files. When a variable file is used, output with possible inaccuracies will be flagged by one of a number of variable error messages.



A second common feature is the **UTILITIES** option, a standard feature in all software packages. This option allows the user to manipulate files, access other directories, change screen colors, and manipulate the position of fields on the coding screen without leaving a particular program. Files can be moved, copied, assigned attributes, sorted, deleted and otherwise managed.

A third common feature is the **JOB-ANALYSIS-REVIEW** sequence of options, available in all software packages except **PLAYBACK**. The **JOB** option allows a user to set up a group of files to be analyzed in a batch file. Each datafile can have its own variable file within the JOB. The **ANALYSIS** option analyzes an individual dataset or a group of datasets in a JOB batchfile according to the program and the parameters selected in the variable file. The **REVIEW** option allows previously created output data files, or entire JOBs of output files, to be reviewed on screen, printed, or both reviewed and printed.

DATA COLLECTION TOOLS

Three different data collection options are described below, from the most simple to the most sophisticated. When coding live events, OCS-LIVE will allow the operator to enter codes directly into the computer. When coding videotape frame by frame, OCS-FRAME will allow the coder to enter codes and scroll frame time with cursor keys. The OCS-VCR systems all record machine readable timecode on videotape and read that timecode while the operator codes the tape, allowing the computer to be completely synchronized with the videotape. Three methods of recording and reading timecode – RT, SMPTE, and VITC – answer to different research needs.

Observational Coding System for Live Events (OCS-LIVE)

OCS-LIVE is designed for live event coding sessions. Events can be coded in the field using a laptop computer, or videotape can be coded as if it were live. Operators or project administrators may create a variable file using the **SUMSTAT** program. The operator begins a coding session by pressing any key. A running system clock (source of time is the PC's internal clock) appears on the computer screen. Each code entered will be timestamped automatically and put into the dataset. Descriptions or comments for any code may be added during or after coding. The dataset may be viewed and codes may be edited during or after coding. If the operator is not immediately sure of the code but knows an event has occurred, he/she can mark the time and the system will wait for a code.

Datasets are saved to disk. Codes may be edited, inserted or deleted from the dataset at any time. Data can be analyzed using the SUMSTAT program or other optional analysis programs.

The OCS-LIVE TOOLSET does not require a hardware interface in order to perform live event coding with the IBM/PC. An OCS-LIVE Toolset and PC system described below are all that is required.

OCS-LIVE Toolset Components:

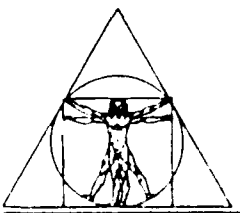
- OCS-LIVE data collection software
- ADMIN, SUMSTAT software

Minimum System Requirements:

- IBM PC, AT, PS/2 or compatible with minimum of 384K RAM, parallel printer port, two double-sided double-density floppy disk drives, Monochrome or Color Monitor and Graphics Card
- DOS 2.1 or later
- OCS-LIVE Toolset

Optional components:

- AGREE, INTERVAL, TSC, DURATION, PATTERN software
- Operator Input System



Observational Coding System for Frame Analysis (OCS-FRAME)

OCS-FRAME includes all the functions of OCS-LIVE. In addition, manual frame coding operations are possible. The coder advances the frame on the VCR and then advances the timestamp by pressing a cursor key. The timestamp advances 1/30th of a second in NTSC video format (American video), and 1/25th of a second for PAL (European) video format. The frame clock can also be reversed, fast forwarded or fast reversed. Time can be computed in "hours:minutes:seconds.tenths and hundredths of seconds" or in "hours:minutes:seconds.frames."

Time should be burned-in onto each video frame, in human readable or machine readable format. Human readable timecode can be accomplished by using a video character generator or the Recordable Video Overlay system (RVO). After time is burned-in to the video, the video overlay system will also allow other computer information (codes, menus) to appear on the same screen as video (optimized data collection). A machine readable timecode is available in frame mode if used with the optional VITC timecode reader/generator, which will allow the CPU to enter frame time automatically (see below). The VITC system also includes a video time character generator for human readable format.

The OCS-FRAME Toolset operates on the same hardware platform as OCS-LIVE. In addition, a VCR, a video monitor, and some method of marking human-readable time characters on each video frame is required.

OCS-FRAME Toolset Components:

- OCS-LIVE and OCS-FRAME data collection software
- ADMIN, SUMSTAT software

Minimum System Requirements:

- All requirements for OCS-LIVE, except OCS-LIVE toolset
- Video Cassette Recorder (VCR)
- Video Monitor and cables
- Video Character Generator or Recordable Video Overlay (RVO) System to use as a Video Character Generator (Note: RVO is available for PC/AT CPU's)
- OCS-FRAME toolset

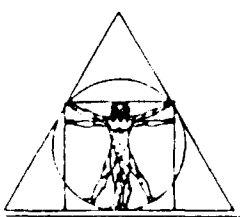
Optional components:

- All OCS-LIVE options; Time Base Corrector (TBC) for use with Video Overlay option; VCR Controller. Upgrade to OCS-VCR-VITC for fully synchronized video frame coding with machine readable timecode.

Observational Coding System for VCR Synchronization (OCS-VCR)

OCS-VCR (RT, SMPTE, or VITC) Toolsets include all OCS-LIVE and OCS-FRAME functions and, in addition, VCR synchronization allows the automatic collection of time from videotape. The operator can recode portions of datasets and keep audit trails of all recoded data. All datasets in which sections of videotape have been coded, rewound, and recoded can have the first set of codes marked with rewind markers. These codes can be ignored in all data calculations, or they can be included, as specified by the user in the PROJECT ADMINISTRATION system prior to their collection.

To accomplish the VCR synchronization task, three hardware options are available: RT, SMPTE, and VITC. Each interface generates timecode to a videotape and reads that timecode. Each system allows different methods of data collection. All OCS-VCR systems require an OCS-VCR TOOLSET or ADVANCED TOOLSET and at least one timecode system. When upgrading to a more advanced hardware platform an upgraded and fully integrated version of the OCS TOOLS is automatically included with the hardware platform purchase.



In addition to **ADMIN** and **SUMSTAT**, all OCS-VCR TOOLS also include **PLAYBACK**. **PLAYBACK** allows the user to play the coded videotape on the video screen while all codes and their times of entry are simultaneously displayed on the computer screen. An audio signal indicates that a code is being displayed on the computer screen. Video and computer information may be displayed on the same screen by using Recordable Video Overlay. The user may choose to review all codes, or only selected codes.

OCS-VCR-RT, SMPTE and VITC provide Real-Time results. Time is recorded at the first keystroke of each code, with no lag or error. Operator Reaction Times can be established to subtract a standard time from each code (see ADMIN).

Each OCS-VCR System requires an OCS-VCR Toolset and a VCR-RT, VCR-SMPTE or VCR-VITC Timecode System.

OCS-VCR Toolset Components:

- OCS-LIVE, FRAME, and VCR data collection software
- ADMIN, SUMSTAT, PLAYBACK software

Optional components:

- Each OCS-VCR system requires selection of a Timecode option (further described below).
- All OCS-VCR systems can be upgraded to include the following OCS Data Analysis and Data Verification Add-Ons: AGREE, INTERVAL, TSC, PATTERN, DURATION software.
- Operator Input System

Complete OCS-VCR Toolset:

- OCS-LIVE, FRAME, and VCR-synchronized data collection software, ADMIN, SUMSTAT, PLAYBACK, AGREE, INTERVAL, TSC, PATTERN, and DURATION software

Additional Options for all OCS-VCR systems:

- Operator Input Software and Hardware for dual keyboard coding or keystroke capture; VCR Controller; Video Overlay; QUAD Video; Video Switching System; Time Base Corrector

OCS-VCR TIMECODE OPTIONS

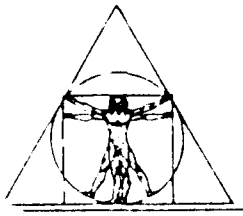
VCR-RT

The VCR-RT (Real-Time) timecode system (for PC and AT CPU's) writes a timecode on one audio channel of a video tape. Coders play the video tape at standard speed while coding. The VCR-RT interface reads and records the timecode from the videotape each time a code is entered. Time may be recorded in several different formats.

The **OCS-VCR-RT** software operates on a similar hardware platform as OCS-FRAME. However, the CPU must have a serial port available. In addition, the VCR-RT Timecode System writes timecode which is machine-readable at normal play speed.

Minimum System Requirements for OCS-VCR-RT:

- All requirements for OCS-FRAME, except for OCS-FRAME toolset, and only IBM PC, AT or compatible with 384K RAM and available COM1 Serial Port. VCR-RT Timecode System
- OCS-VCR Toolset



VCR-SMPTE

A VCR-SMPTE system can operate with PC's, AT's, and PS/2's. Instead of a VCR-RT (real time) hardware interface, VCR-SMPTE timecode systems use a freestanding rackmount SMPTE timecode reader/generator operating with upgraded software and driver.

The SMPTE (Society for Motion Picture and Television Engineers standard) interface writes an industry standard timecode to the audio channel of a videotape. The SMPTE interface will read this timecode from video being coded at video speeds from approximately 1/2 speed to 10x speed. Using **OCS-VCR-SMPTE** software the SMPTE interface can generate time while the coder is collecting data.

Minimum System Requirements for OCS-VCR-SMPTE:

- All requirements for OCS-VCR-RT, except—
- IBM PC, AT, PS/2 or compatible with 384K RAM, parallel printer port, two double-sided, double-density floppy disk drives, and COM1 serial port.
- VCR-SMPTE Timecode System

VCR-VITC

The audio timecode is no longer machine readable at extremely slow speeds (usually below 1/2x speed). For very slow or freeze frame coding, a VCR-VITC timecode system operating in conjunction with a SMPTE interface is required. A VITC (Vertical Interval Timecode) interface will generate an industry standard machine readable timecode on the video channel, in the vertical blanking interval between frames. It can also be used as a character inserter, to write a human readable timecode on each video frame. The VITC interface reads frame time at play speed and slower, including freeze frame (paused) operation. When coding at faster than play speed, the SMPTE processor reads timecode. A VITC timecode can also be generated at the same time a coder is collecting data.

The **OCS-VCR-VITC** software operates on the same hardware platform as OCS-VCR-SMPTE, with the addition of the VCR-VITC Timecode System.

Minimum System Requirements for OCS-VCR-VITC:

- All requirements for OCS-VCR-SMPTE
- VCR-VITC Timecode System

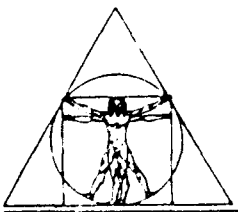
The OCS-VCR TOOLSETS will work with any VCR available which can record and play a standard audio signal (not hi-fidelity filtered). A stereo VCR will work; however, a dual audio channel VCR is suggested, and required to audio dub timecode on one channel while preserving previously recorded audio information on the other channel. Any standard video monitor will be adequate if both a video monitor and computer monitor are used.

OCS OPERATOR INPUT OPTIONS

Operator input systems allow two keyboards to enter data into one CPU. In addition, the Keystroke Capture system allows the second keyboard to enter information into a secondary CPU as well.

DUAL KEYBOARD (OCS-KBD-2)

A second keyboard (OCS-KBD-2) may be added to an OCS TOOLS workstation. This allows two operators to enter codes simultaneously while viewing the same data. Codes from both keyboards are entered into the same dataset in one CPU. A second keyboard option can reduce coding time in half when two coders divide the coding task by tracking different codes.



The OCS-KBD-2 system includes a hardware interface for the AT keyboard, an interface power supply, communications cable, extension cable, and an OCS-KBD-2 software upgrade. AT keyboards are also available. The system will read keystrokes from an IBM PS/2 with a PS/2 converter cable.

KEYSTROKE CAPTURE (**OCS-KBD-CAP**)

Keystroke Capture is designed for collecting keyboard operations from a secondary CPU system. It also includes the features of OCS-KBD-2. In addition, when two CPU's are used, the OCS Workstation automatically collects all keystroke codes and times while the second CPU processes the software for the keyboard operation being coded, such as a word processing or spreadsheet program. A coder can also enter codes at the primary keyboard while observing the keyboard operator. For measuring keyboard operator efficiency, accuracy, and speed, and for software usability studies, OCS-KBD-CAP is the most effective method on the market.

The Keystroke Capture System includes a hardware interface connecting one keyboard to two CPU's, an interface power supply, communications cable, extension cable, and an OCS-KBD-CAP software upgrade. The system will collect keystrokes from a PS/2 with two additional PS/2 converter cables.

SYSTEM ADMINISTRATION TOOLS

PROJECT ADMINISTRATION SYSTEM (**ADMIN**)

The Project Administration System allows a project manager to control a research project involving several coders. Coders can be assigned log-on sequences and differing levels of access to the database. Coders may be limited to entering information, or to collecting and modifying unprotected data, or to collecting and modifying information including protected data. Each coder may be assigned a path and directory, or limited to several but not all paths or directories. Each coder may also be assigned a reaction time which will be subtracted from every entered time to make results more accurate and consistent with frame-by-frame coding.

The project administrator or primary user also uses **ADMIN** to specify which timecode hardware is to be used, whether or not a VCR Controller is to be used, and which format should be used to measure time.

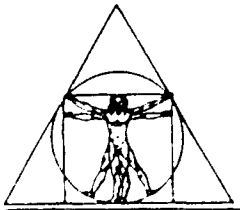
ADMIN is also used to specify whether or not rewind markers are to be used. When a section of videotape is coded, rewound, and recoded, the first set of codes can be marked with rewind markers, indicating that they are NOT to be included in any calculations. They remain in the dataset simply as an "audit trail." However, some applications may require that all codes be considered in statistical calculations; in these applications, rewind markers are not used.

DATA VERIFICATION & OBSERVER TRAINING TOOLS

The two software systems described below are designed to facilitate coder training and data verification. They allow datasets to be compared for agreements, and allow project administrators to review coded datasets synchronized with the videotape which was previously coded.

DATASET AGREEMENT SYSTEM (**AGREE**)

The Dataset Agreement software compares the codes of two datasets and identifies all the agreements between them. The user specifies a time interval and tolerance in which matching codes must be found in both datasets. Time tolerance is used to allow for the differences in coders' reaction times. In addition to identifying agreements and disagreements, AGREE shows the time difference between corresponding observations and calculates Percent Agreement. The information created by AGREE can be used in various interrater reliability calculations. It is also helpful in identifying inconsistencies between coders and training coders to comply with established standards.



DATASET PLAYBACK SYSTEM (**PLAYBACK**)

The Dataset Playback System allows the user to review all entered codes, descriptions, and times while simultaneously watching the videotape which was previously coded. **PLAYBACK** reviews the codes and descriptions in a dataset by displaying them on the computer screen and providing audible feedback at the times they were entered. The user specifies whether only one code, a set of several codes, a class of codes (indicated by wild card characters), or a complete Dataset is to be reviewed. The system uses the timecode recorded on a videotape's audio track or vertical blanking interval to synchronize the computer and VCR and, therefore, requires an OCS-VCR system. PLAYBACK with optional **Recordable Video Overlay** allows the codes and their descriptions to be viewed on the same screen as the videotape. When used with a **VCR Controller**, PLAYBACK can quickly locate any event on the videotape for verification or review. With PLAYBACK, an operator can verify coded video data, check events and associated codes for accuracy, and efficiently train coders.

PLAYBACK UPGRADE (**PLAYBACK-CTRL**)

The PLAYBACK UPGRADE is designed for hardware platforms which include a VCR-CTRL. The upgrade will integrate the VCR Controller System with an OCS-VCR PLAYBACK system. The VCR-CTRL can then be used within PLAYBACK to locate any event or any frame on the tape. The user can also "mark" sections of tape to work within. Keyboard keys are used to rewind to the previous selected code or the next selected code. To review an event, the user can rewind to the beginning of the code in progress on the screen by pressing a key. The system will also do a "pre-roll" prior to the event in progress. The cursor keys can be used to advance or rewind the videotape one frame at a time.

DATA ANALYSIS TOOLS

Except for **SUMSTAT**, the following data analysis systems are optional components and can be added to any OCS TOOLS package. **SUMSTAT** is included with every OCS Toolset.

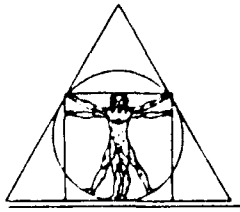
SUMMARY STATISTICS SYSTEM (**SUMSTAT**)

The Summary Statistics program analyzes datasets and calculates the frequency and duration of specific events. It provides figures for total frequency, total duration, mean duration, minimum duration, maximum duration, and standard deviation. The user specifies the parameters under which SUMSTAT operates by creating a variable file containing information about the coding method used, the specific events to be analyzed, and the number and name(s) of the dataset(s) to be analyzed.

SUMSTAT then uses this information to analyze a dataset or set of datasets and creates an output file(s).

INTERVAL ANALYSIS SYSTEM (**INTERVAL**)

The Interval Analysis software analyzes intervals within a Dataset and calculates the frequency and duration of specific events. It provides figures for total duration and percent of duration within intervals. The beginning and ending of intervals can be defined by an event determined by the user. The occurrence of this event then signals the end of one interval and the beginning of the next. Intervals of equal duration can be created by adding a marker-code in the dataset to mark the beginning of intervals. External datasets can be defined as a source for interval definitions.



The program also calculates the rate of occurrence of events within intervals. The user specifies the unit of time to be used in the calculation of rate, to obtain a standard measure of frequency across intervals of different lengths. This time unit is called a grouping variable and can range from one second to the length of the entire dataset. By choosing a grouping variable of 60 seconds, for example, it is possible to calculate the rate-per-minute of events during each interval.

TIME SERIES COMPARISON SYSTEM (**TSC**)

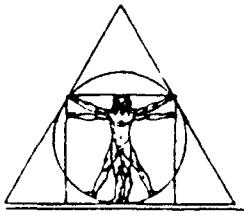
The Time Series Comparison software allows up to 8 comparisons using up to 8 different datasets and/or up to 8 different variable files over a common time period. Time is listed in one column and the codes from each dataset/variable file are listed in adjoining columns. Events to be analyzed can be the same or different for each dataset. The system allows informal comparisons, but does no formal data analysis.

DURATION ANALYSIS SYSTEM (**DURATION**)

The Duration Analysis software lists the consecutive events within a Dataset. Each line of the report includes the duration of each individual incident as well as the cumulative duration of each event. It also includes the time from the dataset as well as the absolute time resulting from correcting the first code's time to 00:00:00.00. One or more events can be selected for analysis, by using a variable file.

PATTERN ANALYSIS SYSTEM (**PATTERN**)

The Pattern Analysis software (PATTERN) allows the user to specify a sequence of up to 10 codes within a dataset and search for all the occurrences of that exact sequence. The software also lists the times and dataset record numbers for each code in each occurrence of the sequence.



MULTIMEDIA TOOLS 1

Multimedia Tools allow various types of integration between PC and VCR in order to facilitate research involving both personal computers and videotaped data.

The Video Timecode systems write machine readable timecode to each frame of a videotape, and read that timecode when the videotape is being coded. This allows the PC to automatically timestamp each code, and also allows the coder to rewind and recode without affecting accuracy of the data. The Video Tape Controller Systems allow coders to control up to eight VCR's from the PC keyboard. The Recordable Video Overlay System allows computer information to be displayed on the same screen as video.

VIDEO TIMECODE SYSTEMS

VCR-RT TIMECODE SYSTEM

The VCR-RT (Real Time) Timecode System produces machine readable timecode on one audio track of a videotape. It automatically reads and enters time into the dataset each time a code is entered, when videotape is coded at normal "play" speed. The VCR-RT Timecode System consists of a hardware interface, cableset, driver, and complete software integration with OCS-VCR system.

VCR-SMPTE TIMECODE SYSTEM

The VCR-SMPTE Timecode System produces industry standard machine readable timecode on one audio track of a videotape. It automatically reads and enters time into the dataset each time a code is entered, when videotape is coded at normal, fast, or slow speeds (from 1/2 "play" speed to 10x "play" speed). The VCR-SMPTE Timecode System consists of a hardware interface, cableset, driver, and complete software integration with OCS-VCR system.

VCR-VITC TIMECODE SYSTEM

The VCR-VITC Timecode System operates in addition to the VCR-SMPTE system (required). It writes human and machine readable timecode to the video track of a video tape. Time is automatically read and entered into the dataset each time a code is entered when videotape is coded at any speed, including paused or freeze-frame. The VCR-VITC Timecode System consists of a rackmountable hardware interface, cableset, driver, and complete software integration with OCS-VCR system.

VIDEO TAPE CONTROLLER SYSTEMS

VCR-CTRL SYSTEM

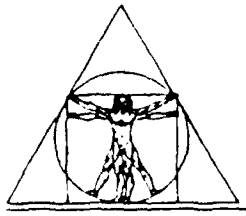
The VCR-CTRL System allows an operator to control a VCR from the PC keyboard. Numerous VCR-CTRL systems (up to 8) can exist in one CPU, providing selectable master/slave configurations for simultaneous operations. The user can rewind, fast forward, record, audio dub, pause, or search using PC keyboard keys. The VCR-CTRL System includes a hardware interface, cableset, software driver, and a memory resident software system for use with any 100% IBM PC compatible software package.

Currently VCR Controllers will operate with these VCR's:

- Panasonic AG6000 series, 34 pin VCR's (6100, 6200, 6300, 6500)
- Panasonic AG7000 series, 34 pin VCR's (7100, 7200, 7300, 7500)
- JVC BR-0000-U series, 45 pin VCR's (5300, 6400, 7700, 8600)
- JVC BRS-000-U series, 45 pin VCR's (611, 711, 811)

The VCR Controller will soon operate with these additional VCR's:

- Sony BVU-8000 series, 36 pin VCR's, and Sony Type-1 Control VCR's
- Panasonic AG-1960



Minimum System Requirements:

- One VCR Controller circuit board for each VCR to be controlled from the PC, software driver, and TSR software system.
- Cable to connect PC with VCR. VCR Controller Cables are VCR specific (i.e. a Panasonic cable will not operate on JVC VCR's).
- IBM PC, AT or 100% compatible computer with one available expansion slot for each VCR to be controlled from the PC keyboard
- From one to eight compatible VCR's

COMPUTER/VIDEO OVERLAY EQUIPMENT

RECORDABLE VIDEO OVERLAY SYSTEM (RVO)

The Recordable Video Overlay System (RVO) allows the user to view video images and computer-generated information on one monitor simultaneously. Coders can choose menu options from the video screen, see the system clock and entered codes, and call up any needed information. This eliminates the need to scan between two monitors during coding. Operators are less likely to miss codable events, resulting in more accurate gathering of data with fewer videotape rewinds.

RVO also allows the user to make videotapes of the information in overlay mode, such as video frame time, event codes, and code descriptions. This eliminates the need to scan between two monitors during **PLAYBACK** sessions. A videotape can be made of previously coded datasets and used to train coders, without the additional requirement of a computer. The RVO system can be used to make videotapes of any computer overlaid video sequence, and is not restricted to use with the OCS TOOLS.

Minimum system requirements:

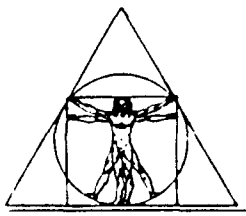
Two RVO systems are currently available: RVO-E (EGA) and RVO-V (VGA). Both include the EGA or VGA graphics card and software, the RVO hardware and software, and the required cableset. In addition, the following equipment is required to run an RVO System:

- IBM/PC, AT, or 100% compatible computer
- Video monitor or Analog-RGB/Video Monitor with cables
- Video source (e.g. VCR or video camera)
- Video Cassette Recorder with cables (for use as target VCR)

Any standard video monitor can be used with a Recordable Video Overlay system. However, screen colors may be better with an Analog RGB/NTSC monitor. In order to view computer information without underlying video on the same monitor which is also used for video, an Analog RGB/NTSC monitor is required.

The screen quality is best when the RVO System is used in Video Overlay mode and it is recommended that Recordable Video Overlay mode be used only for making recordings. If the system is mainly to be used in Video Overlay mode, it is also required that an Analog/RGB monitor be used rather than a video monitor, since this improves screen color quality when computer information is being viewed. If coding requires that the videotape be paused (freeze framed), it is also recommended that the system include either a monochrome monitor to display computer information during freeze-frame coding, or that a Time Base Corrector (TBC) be installed to properly sync video and computer information on one screen.

Any VCR currently on the market (NTSC standard) can be used. However, S-VHS VCR's are not currently compatible with RVO systems unless a SVHS-TBC is used in the system (call for availability of overlay systems for output to S-VHS VCR's). Slow motion work with an RVO system requires specific video components; call TRC for information.

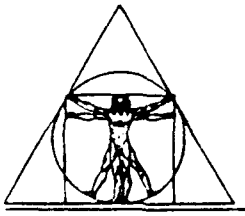


PRICELIST NOTES

(1) Also available as part of the DATA ANALYSIS SET.
(2) Includes all software described as DATA ANALYSIS TOOLS + AGREE (DATA VERIFICATION & OBSERVER TRAINING TOOL).
(3) Includes all OCS-VCR + DATA ANALYSIS SET.
(4) Does not include keyboard.
(5) Trade-ins are available on existing OCS-KBD-2 systems when upgrading to OCS-KBD-CAP.
(6) OCS-KBD-2 Systems require 1 cable (Type A), while OCS-KBD-CAP Systems require 2 cables (Types A & B).
(7) Special pricing is available for this product for a short time period, call TRC for details.
(8) Trade-ins are available on existing systems when upgrading from VCR-RT to SMPTE or SMPTE/VITC.
(9) Requires a PLAYBACK-CTRL system for integration with OCS-VCR PLAYBACK.
(10) A-RGB Monitor Cables are not included, nor required. Only video cables are necessary, but may be supplemented with A-RGB cables for finer color viewing.
(11) Can be used in slow motion and freeze frame modes with RVO. VCR's require slight modifications.
(12) Price depends on configuration.

GENERAL NOTES

(A) All prices are subject to change without notice.
(B) Special pricing is available for groups.
(C) Export pricing is 10% higher.
(D) Installation, Training, Annual Software Upgrades and Annual Hardware Warranty Extensions are available. Call TRC for information.



CUSTOMER SERVICE

TRC is committed to serving the research community. We will provide the best support possible so you may get the best results from our products.

CUSTOMIZED SYSTEM INTEGRATION

TRC offers complete system integration. We will completely customize your system, integrate the OCS TOOLS with your existing hardware, or assist you or your staff in developing the exact system you need.

INSTALLATION AND ON-SITE TRAINING

On-site installation and/or training of project leaders or teams is available upon request.

CUSTOMIZED PRODUCT DEVELOPMENT

Software application customization and product design/ development (software and hardware) services are available according to customer specifications.

TELEPHONE SUPPORT, UPGRADES & WARRANTY

All OCS TOOLS products developed in-house at TRC are covered by:

- ▲ **12 Months of Telephone Line Support**
- ▲ **12 Months of Software Upgrades**
- ▲ **12 Month Limited Warranty**

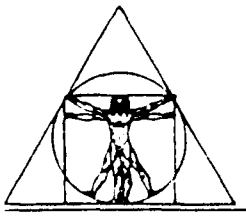
TRC personnel will be available during workday hours to answer questions and help solve any problems which might arise.

TRC regularly updates products and encourages product upgrade suggestions from customers. Updates of OCS TOOLS developed by TRC are distributed free of charge to customers covered under TRC's 12 month limited warranty and update policy. Extended service and product update contracts are also available for coverage beyond the initial twelve month period.

LICENSE AGREEMENT

ALL ORDERS ARE SUBJECT TO THE TERMS AND CONDITIONS OF TRC'S SOFTWARE LICENSE AGREEMENT. ALL TRC SOFTWARE IS LICENSED ONLY; IT IS NOT SOLD. IF YOU THE CUSTOMER DO NOT AGREE TO ABIDE BY EACH AND EVERY TERM OF THE TRC LICENSE AGREEMENT, THEN YOU MAY RETURN THE SOFTWARE, UNOPENED AND UNUSED, FOR A FULL REFUND. IF YOU OPEN AND/OR USE THE SOFTWARE, THEN YOUR OPENING AND/OR USE CONSTITUTES ACCEPTANCE OF ALL THE TERMS OF THE LICENSE AGREEMENT.

A copy of the License Agreement and of TRC's Limited Warranty on its hardware and software may be obtained in advance of placing an order by calling or writing TRC. A copy of the Limited Warranty and of the License Agreement will be enclosed with each order shipped.



RESEARCH SYSTEMS

OCS TOOLS

DATA COLLECTION TOOLS

OCS-LIVE TOOLSET	475.00
OCS-FRAME TOOLSET	750.00
OCS-VCR TOOLSET	2,725.00

SYSTEM ADMINISTRATION TOOLS

ADMIN	NC

DATA VERIFICATION & OBSERVER TRAINING TOOLS

AGREE (1)	295.00
PLAYBACK	NC
PLAYBACK-CTRL	450.00

DATA ANALYSIS TOOLS

SUMSTAT	NC
INTERVAL	295.00
TSC	295.00
DURATION	295.00
PATTERN	295.00

BUNDLED TOOLSETS

DATA ANALYSIS SET (2)	995.00
OCS-VCR + DATA ANALYSIS SET (3)	3,700.00

OPERATOR INPUT OPTIONS

DUAL KEYBOARD SYSTEM (OCS-KBD-2) (4,5)	800.00
KEYSTROKE CAPTURE (OCS-KBD-CAP) (4)	1,200.00
AT KEYBOARD	125.00
PS/2 COMPATIBILITY CABLE (6)	15.00

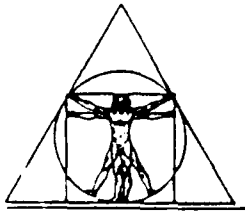
MAS TOOLS

MOTION ANALYSIS SYSTEM TOOLSET (7)	Call

COMPUTERS AND WORKSTATIONS

INTEGRATED WORKSTATIONS

PC PORTABLE WORKSTATION (12)	Call
AT DESKTOP WORKSTATION (12)	Call
386/SX DESKTOP WORKSTATION (12)	Call
386 DESKTOP WORKSTATION (12)	Call
486 DESKTOP WORKSTATION (12)	Call



MULTIMEDIA COMPONENTS

VIDEO TIMECODE SYSTEMS

VCR-RT TIMECODE SYSTEM (8)	625.00
VCR-SMPTE TIMECODE SYSTEM	2,250.00
VCR-VITC TIMECODE SYSTEM	2,150.00

VIDEO TAPE CONTROLLER SYSTEMS

VCR-CTRL SYSTEM (9)	975.00

COMPUTER/VIDEO OVERLAY SYSTEMS

RECORDABLE VIDEO OVERLAY SYSTEM (RVO-E) (10)	1,245.00
RECORDABLE VIDEO OVERLAY SYSTEM (RV0-V) (10)	1.355.00

SUPPLEMENTAL VIDEO EQUIPMENT

ANALOG-RGB/NTSC VIDEO MONITORS

SONY PVM-1910 (19" Monitor)	Call
SONY PVM-1910-Q (19" Monitor, NTSC/PAL)	Call
SONY PVM-1242-Q (12" Monitor, NTSC/PAL)	Call
SONY KV-1311-CR (13" Monitor)	Call
RVO CABLES FOR ANALOG-RGB/NTSC MONITORS	95.00

VIDEO CASSETTE RECORDERS

DUAL AUDIO VHS VCR'S

PAN. AG-6300 (+video sync)	2,420.00
PAN. AG-6500 (editor, +video sync)	4,395.00
JVC BR-7700U (+video sync) (11)	Call
JVC BR-8600U (editor, +video sync) (11)	Call

DUAL AUDIO S-VHS VCR'S

PAN. AG-7300 (+video sync) (11)	Call
PAN. AG-7500 (editor, +video sync) (11)	Call
JVC BR-611U (+video sync) (11)	Call
JVC BR-811U (editor, +video sync) (11)	Call

TIME BASE CORRECTOR SYSTEMS

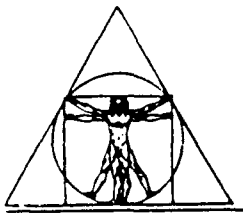
VHS-TBC (HETERODYNE TBC) (11)	2,950.00
SVHS-TBC (SUBCARRIER TBC)	3,560.00

VIDEO SWITCHING/MIXING SYSTEMS

RVO VIDEO SELECTION SYSTEM	85.00
ACTIVE VIDEO SWITCH SYSTEM	335.00
QUAD VIDEO SYSTEM	2,070.00

VIDEO RACKS AND RACKMOUNT EQUIPMENT

RACK CARRIER SYSTEM (12)	Call
COMPONENT RACK MOUNTS (12)	Call
RACKMOUNT CPU CASES (12)	Call



Appendix 2

OBSERVATIONAL CODING SYSTEM TOOLS (tm)

The Observational Coding System Tools (OCS TOOLS (tm)) integrate software and hardware for observational data collection, editing, records management, and data analysis. The OCS TOOLS can improve the reliability and efficiency of observational data collection procedures.

The OCS TOOLS are a modular system of components, making possible a wide variety of customized data collection configurations. Purchase only the items required for specific data collection and analysis projects. OCS TOOLS will operate on IBM-PC, XT, AT, PS/2 or 100% compatible machines.

Three types of basic systems (OCS-LIVE, OCS-FRAME, and OCS-VCR) are available to meet specific project needs. Each can be enhanced by a number of additional software and hardware options.

UNIVERSAL FEATURES

PC Serves as Event Recorder

All OCS Systems allow the user to enter codes directly into the computer and can be used to code live events and events recorded on videotape. Codes are entered at the computer's keyboard and may be up to 10 characters long. Additional descriptive information may be added for a code during or after a coding session. Coding may be done in a continuous fashion for discreet events or by using start/stop codes for overlapping events.

Automatic Timestamping

The computer automatically records the time at which the codes were entered. However, the source of time is different for each type of system. OCS-LIVE records time from the CPU's internal clock. OCS-FRAME allows the operator to scroll time forward or backward in standardized increments (increments vary according to video format), matching time to that recorded on a video frame. This time is automatically entered when the operator enters a code. OCS-VCR automatically reads time from each video frame, allowing the computer to remain synchronized with the videotape even after rewinding or fast forwarding.

Dataset Editing and Merging Functions

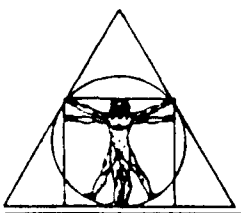
Each of the data collection tools includes an optimized interface for collecting event data. Datasets may be edited at any time. A coding session Mini-Editor can be used to review and edit codes during coding sessions. The full editing software may be used to review and edit datasets which have been collected and/or stored. A data collection audit trail, used to mark outdated codes, is available on all OCS-VCR systems. Datasets generated by any data collection tool can be merged together to create larger datasets.

Easy to Use Menu Driven Software and Manual

All OCS Tools are easy to learn and operate. Screen menus offer a choice of actions. Knowledge of operating each software system is highly transferable to other OCS software, increasing the speed with which learning new systems occurs. Screen prompts for hardware setup procedures are included for those systems which involve resetting hardware for coding or playback. A comprehensive user's manual details software operation and hardware setup procedures.

System Administration Functions

Each data collection tool includes a Project Administration System (**ADMIN**) which allows a project manager to select which hardware will be operational, which timecode and duration format will appear on data printouts, whether or not rewind markers are used, and whether NTSC or PAL videotape is being used.



The project administrator can also assign log-on rights to coders, limit any coder's access to the data, specify path and directory limits, and specify operator reaction time (which can be calculated with other tool components).

Dataset Verification and Observer Training Functions

All OCS-VCR systems include a Dataset Playback System (**PLAYBACK**), which allows the user to watch a videotape while the computer provides information about which codes and descriptions have occurred. An optional Dataset Agreement System (**AGREE**) allows project administrators to compare two coding sessions of the same observation, to determine where coders agreed and where they disagreed.

Dataset Analysis Functions

Each data collection tool includes the Summary Statistics System (**SUMSTAT**), which calculates frequency and duration of specified events (including total frequency, total duration, mean duration, minimum duration, maximum duration, and standard deviation), and prepares data for further analysis.

A number of other analysis tools are also available for any of the data collection systems. These include an Interval Analysis System (**INTERVAL**), Time Series Comparison System (**TSC**), Duration Analysis System (**DURATION**), and Pattern Analysis System (**PATTERN**).

Compatibility

Data collected with the OCS TOOLS may be organized and analyzed using any hardware/software system which will accept ASCII files.

All OCS hardware and software components are completely compatible with system upgrades, and all data gathered with present systems will be compatible with future software updates and with system upgrades.

All upper level systems are completely compatible with and contain all features of lower level systems, making it easy to upgrade to a more sophisticated method of synchronization at a later time.

ADVANTAGES OF THE OCS TOOLS

OCS makes it easy to code

Codes are entered directly into the computer, and automatically timestamped.

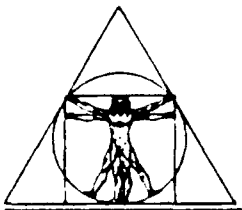
OCS software is optimized to speed the collection of various types of data and adapts to any coding system. Enter codes of different lengths. Codes may be from 1 to 10 characters long. Letters, numbers, and spaces may be part of any code. Upper and lower case letters are differentiated.

Create new codes during a coding session if needed. If an event is not immediately clear, enter a time (by pressing spacebar) and then enter the code when ready. Add descriptive comments to any code at any time. Edit codes at any time—during or after the coding session. Rewind the videotape and recode portions of tape to increase accuracy. Code videotape at the optimal tape speed—normal play speed, slow, freeze-frame, or faster than "play" speed. Change video speeds during a coding session without affecting results.

OCS eliminates common coding errors

Automatic timestamping insures accurate time recording and eliminates transcription errors. Look-away error during live coding in the field is reduced with the easy to use coding system. With video, look-away error can be entirely prevented by using a video-overlay system.

Datafiles can be converted into Reports and checked for common coding errors using **VARIABLE** definitions.



OCS saves time and money

OCS allows accurate results to be entered and checked quickly. Summary Statistics and Interrater Reliability data are immediately available with **SUMSTAT** and **AGREE**. Data is saved directly to disk, eliminating transcription. A dual keyboard system (**OCS-KBD-2**) allows two coders to code one videotape (or live event) simultaneously, dividing the coding task and reducing coding time by half. For Software Usability applications, Keystroke Capture (**OCS-KBD-CAP**) will automatically collect keyboard operations from a second CPU system, without the need for an observer.

OCS is adaptable to large or small research teams

Project administrators can set up a database of users with varying access rights. Coders can be trained to recognize codes using the **PLAYBACK** program, and checked for accuracy using the **AGREE** program. An operator reaction time factor can be assigned to individual coders in order to collect data that is more accurate and similar to data collected at a frame-by-frame rate. This feature saves coding time by allowing operators to code videotape moving at faster speeds.

OCS makes data management easy

Two or more datafiles can be merged.

A VARIABLE file can be used to delimit the information to be analyzed in any datafile. Wild-card characters (*,?) may be used to specify classes or groups of codes.

A file management system included in every software package allows files to be copied or moved to another directory, renamed, sorted, deleted, assigned attributes, or selected according to a parameter, such as file name extension or date, without leaving the system.

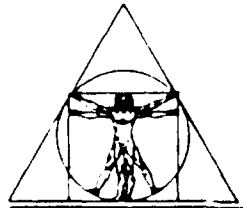
DESCRIPTION OF THE OCS TOOLS

The Observational Coding System is a modular system of software and hardware components. Minimum requirements for each type of system—LIVE, FRAME, and VCR—are listed below. Each system includes data collection software (**OCS**), system administration software (**ADMIN**), records management, editing and reporting tools, a summary statistics software package (**SUMSTAT**), a comprehensive user's manual, and 12 months of software updates, telephone line support, and limited warranty. All OCS-VCR systems also include **PLAYBACK**, a data verification and observer training software tool.

Additional data analysis software is available and is described below. In addition to the video timecode system hardware requirements for OCS-VCR systems, additional multimedia tools and other hardware options are also described below.

GENERAL SOFTWARE FEATURES

The data collection and analysis software described below share several features. One is the **VARIABLE FILE**. A variable file can be created and/or used in any of these packages: **SUMSTAT**, **INTERVAL**, **AGREE**, **DURATION**, and **TSC**. A variable file selects which codes will be analyzed. Select one code, several codes, all codes, or a class of codes using wild card characters (such as "All codes beginning with the letter A = A*"). The variable file also indicates which type of coding was used (continuous for discrete events or start/stop for overlapping events). One dataset may be analyzed with multiple variable files. When a variable file is used, output with possible inaccuracies will be flagged by one of a number of variable error messages.



A second common feature is the **UTILITIES** option, a standard feature in all software packages. This option allows the user to manipulate files, access other directories, change screen colors, and manipulate the position of fields on the coding screen without leaving a particular program. Files can be moved, copied, assigned attributes, sorted, deleted and otherwise managed.

A third common feature is the **JOB-ANALYSIS-REVIEW** sequence of options, available in all software packages except **PLAYBACK**. The **JOB** option allows a user to set up a group of files to be analyzed in a batch file. Each datafile can have its own variable file within the JOB. The **ANALYSIS** option analyzes an individual dataset or a group of datasets in a JOB batchfile according to the program and the parameters selected in the variable file. The **REVIEW** option allows previously created output data files, or entire JOBs of output files, to be reviewed on screen, printed, or both reviewed and printed.

DATA COLLECTION TOOLS

Three different data collection options are described below, from the most simple to the most sophisticated. When coding live events, OCS-LIVE will allow the operator to enter codes directly into the computer. When coding videotape frame by frame, OCS-FRAME will allow the coder to enter codes and scroll frame time with cursor keys. The OCS-VCR systems all record machine readable timecode on videotape and read that timecode while the operator codes the tape, allowing the computer to be completely synchronized with the videotape. Three methods of recording and reading timecode – RT, SMPTE, and VITC – answer to different research needs.

Observational Coding System for Live Events (OCS-LIVE)

OCS-LIVE is designed for live event coding sessions. Events can be coded in the field using a laptop computer, or videotape can be coded as if it were live. Operators or project administrators may create a variable file using the **SUMSTAT** program. The operator begins a coding session by pressing any key. A running system clock (source of time is the PC's internal clock) appears on the computer screen. Each code entered will be timestamped automatically and put into the dataset. Descriptions or comments for any code may be added during or after coding. The dataset may be viewed and codes may be edited during or after coding. If the operator is not immediately sure of the code but knows an event has occurred, he/she can mark the time and the system will wait for a code.

Datasets are saved to disk. Codes may be edited, inserted or deleted from the dataset at any time. Data can be analyzed using the SUMSTAT program or other optional analysis programs.

The OCS-LIVE TOOLSET does not require a hardware interface in order to perform live event coding with the IBM/PC. An OCS-LIVE Toolset and PC system described below are all that is required.

OCS-LIVE Toolset Components:

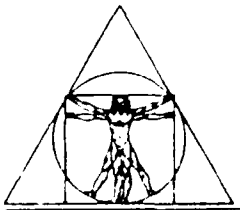
- OCS-LIVE data collection software
- ADMIN, SUMSTAT software

Minimum System Requirements:

- IBM PC, AT, PS/2 or compatible with minimum of 384K RAM, parallel printer port, two double-sided double-density floppy disk drives, Monochrome or Color Monitor and Graphics Card
- DOS 2.1 or later
- OCS-LIVE Toolset

Optional components:

- AGREE, INTERVAL, TSC, DURATION, PATTERN software
- Operator Input System



Observational Coding System for Frame Analysis (OCS-FRAME)

OCS-FRAME includes all the functions of OCS-LIVE. In addition, manual frame coding operations are possible. The coder advances the frame on the VCR and then advances the timestamp by pressing a cursor key. The timestamp advances 1/30th of a second in NTSC video format (American video), and 1/25th of a second for PAL (European) video format. The frame clock can also be reversed, fast forwarded or fast reversed. Time can be computed in "hours:minutes:seconds.tenths and hundredths of seconds" or in "hours:minutes:seconds.frames."

Time should be burned-in onto each video frame, in human readable or machine readable format. Human readable timecode can be accomplished by using a video character generator or the Recordable Video Overlay system (RVO). After time is burned-in to the video, the video overlay system will also allow other computer information (codes, menus) to appear on the same screen as video (optimized data collection). A machine readable timecode is available in frame mode if used with the optional VITC timecode reader/generator, which will allow the CPU to enter frame time automatically (see below). The VITC system also includes a video time character generator for human readable format.

The OCS-FRAME Toolset operates on the same hardware platform as OCS-LIVE. In addition, a VCR, a video monitor, and some method of marking human-readable time characters on each video frame is required.

OCS-FRAME Toolset Components:

- OCS-LIVE and OCS-FRAME data collection software
- ADMIN, SUMSTAT software

Minimum System Requirements:

- All requirements for OCS-LIVE, except OCS-LIVE toolset
- Video Cassette Recorder (VCR)
- Video Monitor and cables
- Video Character Generator or Recordable Video Overlay (RVO) System to use as a Video Character Generator (Note: RVO is available for PC/AT CPU's)
- OCS-FRAME toolset

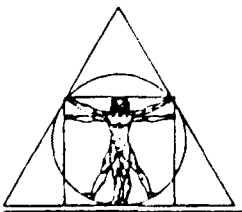
Optional components:

- All OCS-LIVE options; Time Base Corrector (TBC) for use with Video Overlay option; VCR Controller. Upgrade to OCS-VCR-VITC for fully synchronized video frame coding with machine readable timecode.

Observational Coding System for VCR Synchronization (OCS-VCR)

OCS-VCR (RT, SMPTE, or VITC) Toolsets include all OCS-LIVE and OCS-FRAME functions and, in addition, VCR synchronization allows the automatic collection of time from videotape. The operator can recode portions of datasets and keep audit trails of all recoded data. All datasets in which sections of videotape have been coded, rewound, and recoded can have the first set of codes marked with rewind markers. These codes can be ignored in all data calculations, or they can be included, as specified by the user in the PROJECT ADMINISTRATION system prior to their collection.

To accomplish the VCR synchronization task, three hardware options are available: RT, SMPTE, and VITC. Each interface generates timecode to a videotape and reads that timecode. Each system allows different methods of data collection. All OCS-VCR systems require an OCS-VCR TOOLSET or ADVANCED TOOLSET and at least one timecode system. When upgrading to a more advanced hardware platform, an upgraded and fully integrated version of the OCS TOOLS is automatically included with the hardware platform purchase.



In addition to **ADMIN** and **SUMSTAT**, all OCS-VCR TOOLS also include **PLAYBACK**. **PLAYBACK** allows the user to play the coded videotape on the video screen while all codes and their times of entry are simultaneously displayed on the computer screen. An audio signal indicates that a code is being displayed on the computer screen. Video and computer information may be displayed on the same screen by using Recordable Video Overlay. The user may choose to review all codes, or only selected codes.

OCS-VCR-RT, SMPTE and VITC provide Real-Time results. Time is recorded at the first keystroke of each code, with no lag or error. Operator Reaction Times can be established to subtract a standard time from each code (see ADMIN).

Each OCS-VCR System requires an OCS-VCR Toolset and a VCR-RT, VCR-SMPTE or VCR-VITC Timecode System.

OCS-VCR Toolset Components:

- OCS-LIVE, FRAME, and VCR data collection software
- ADMIN, SUMSTAT, PLAYBACK software

Optional components:

- Each OCS-VCR system requires selection of a Timecode option (further described below).
- All OCS-VCR systems can be upgraded to include the following OCS Data Analysis and Data Verification Add-Ons: AGREE, INTERVAL, TSC, PATTERN, DURATION software.
- Operator Input System

Complete OCS-VCR Toolset:

- OCS-LIVE, FRAME, and VCR-synchronized data collection software, ADMIN, SUMSTAT, PLAYBACK, AGREE, INTERVAL, TSC, PATTERN, and DURATION software

Additional Options for all OCS-VCR systems:

- Operator Input Software and Hardware for dual keyboard coding or keystroke capture; VCR Controller; Video Overlay; QUAD Video; Video Switching System; Time Base Corrector

OCS-VCR TIMECODE OPTIONS

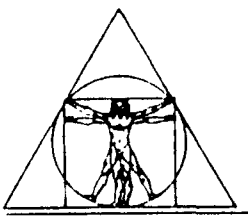
VCR-RT

The VCR-RT (Real-Time) timecode system (for PC and AT CPU's) writes a timecode on one audio channel of a video tape. Coders play the video tape at standard speed while coding. The VCR-RT interface reads and records the timecode from the videotape each time a code is entered. Time may be recorded in several different formats.

The **OCS-VCR-RT** software operates on a similar hardware platform as OCS-FRAME. However, the CPU must have a serial port available. In addition, the VCR-RT Timecode System writes timecode which is machine-readable at normal play speed.

Minimum System Requirements for OCS-VCR-RT:

- All requirements for OCS-FRAME, except for OCS-FRAME toolset, and only IBM PC, AT or compatible with 384K RAM and available COM1 Serial Port.
- VCR-RT Timecode System
- OCS-VCR Toolset



VCR-SMPTE

A VCR-SMPTE system can operate with PC's, AT's, and PS/2's. Instead of a VCR-RT (real time) hardware interface, VCR-SMPTE timecode systems use a freestanding rackmount SMPTE timecode reader/generator operating with upgraded software and driver.

The SMPTE (Society for Motion Picture and Television Engineers standard) interface writes an industry standard timecode to the audio channel of a videotape. The SMPTE interface will read this timecode from video being coded at video speeds from approximately 1/2 speed to 10x speed. Using **OCS-VCR-SMPTE** software the SMPTE interface can generate time while the coder is collecting data.

Minimum System Requirements for OCS-VCR-SMPTE:

- All requirements for OCS-VCR-RT, except—
- IBM PC, AT, PS/2 or compatible with 384K RAM, parallel printer port, two double-sided, double-density floppy disk drives, and COM1 serial port.
- VCR-SMPTE Timecode System

VCR-VITC

The audio timecode is no longer machine readable at extremely slow speeds (usually below 1/2x speed). For very slow or freeze frame coding, a VCR-VITC timecode system operating in conjunction with a SMPTE interface is required. A VITC (Vertical Interval Timecode) interface will generate an industry standard machine readable timecode on the video channel, in the vertical blanking interval between frames. It can also be used as a character inserter, to write a human readable timecode on each video frame. The VITC interface reads frame time at play speed and slower, including freeze frame (paused) operation. When coding at faster than play speed, the SMPTE processor reads timecode. A VITC timecode can also be generated at the same time a coder is collecting data.

The **OCS-VCR-VITC** software operates on the same hardware platform as OCS-VCR-SMPTE, with the addition of the VCR-VITC Timecode System.

Minimum System Requirements for OCS-VCR-VITC:

- All requirements for OCS-VCR-SMPTE
- VCR-VITC Timecode System

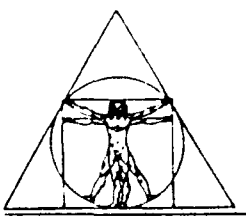
The OCS-VCR TOOLSETS will work with any VCR available which can record and play a standard audio signal (not hi-fidelity filtered). A stereo VCR will work; however, a dual audio channel VCR is suggested, and required to audio dub timecode on one channel while preserving previously recorded audio information on the other channel. Any standard video monitor will be adequate if both a video monitor and computer monitor are used.

OCS OPERATOR INPUT OPTIONS

Operator input systems allow two keyboards to enter data into one CPU. In addition, the Keystroke Capture system allows the second keyboard to enter information into a secondary CPU as well.

DUAL KEYBOARD (OCS-KBD-2)

A second keyboard (OCS-KBD-2) may be added to an OCS TOOLS workstation. This allows two operators to enter codes simultaneously while viewing the same data. Codes from both keyboards are entered into the same dataset in one CPU. A second keyboard option can reduce coding time in half when two coders divide the coding task by tracking different codes.



The OCS-KBD-2 system includes a hardware interface for the AT keyboard, an interface power supply, communications cable, extension cable, and an OCS-KBD-2 software upgrade. AT keyboards are also available. The system will read keystrokes from an IBM PS/2 with a PS/2 converter cable.

KEYSTROKE CAPTURE (**OCS-KBD-CAP**)

Keystroke Capture is designed for collecting keyboard operations from a secondary CPU system. It also includes the features of OCS-KBD-2. In addition, when two CPU's are used, the OCS Workstation automatically collects all keystroke codes and times while the second CPU processes the software for the keyboard operation being coded, such as a word processing or spreadsheet program. A coder can also enter codes at the primary keyboard while observing the keyboard operator. For measuring keyboard operator efficiency, accuracy, and speed, and for software usability studies, OCS-KBD-CAP is the most effective method on the market.

The Keystroke Capture System includes a hardware interface connecting one keyboard to two CPU's, an interface power supply, communications cable, extension cable, and an OCS-KBD-CAP software upgrade. The system will collect keystrokes from a PS/2 with two additional PS/2 converter cables.

SYSTEM ADMINISTRATION TOOLS

PROJECT ADMINISTRATION SYSTEM (**ADMIN**)

The Project Administration System allows a project manager to control a research project involving several coders. Coders can be assigned log-on sequences and differing levels of access to the database. Coders may be limited to entering information, or to collecting and modifying unprotected data, or to collecting and modifying information including protected data. Each coder may be assigned a path and directory, or limited to several but not all paths or directories. Each coder may also be assigned a reaction time which will be subtracted from every entered time to make results more accurate and consistent with frame-by-frame coding.

The project administrator or primary user also uses **ADMIN** to specify which timecode hardware is to be used, whether or not a VCR Controller is to be used, and which format should be used to measure time.

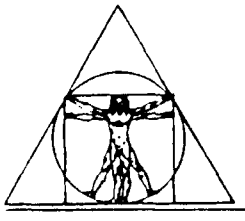
ADMIN is also used to specify whether or not rewind markers are to be used. When a section of videotape is coded, rewound, and recoded, the first set of codes can be marked with rewind markers, indicating that they are NOT to be included in any calculations. They remain in the dataset simply as an "audit trail." However, some applications may require that all codes be considered in statistical calculations; in these applications, rewind markers are not used.

DATA VERIFICATION & OBSERVER TRAINING TOOLS

The two software systems described below are designed to facilitate coder training and data verification. They allow datasets to be compared for agreements, and allow project administrators to review coded datasets synchronized with the videotape which was previously coded.

DATASET AGREEMENT SYSTEM (**AGREE**)

The Dataset Agreement software compares the codes of two datasets and identifies all the agreements between them. The user specifies a time interval and tolerance in which matching codes must be found in both datasets. Time tolerance is used to allow for the differences in coders' reaction times. In addition to identifying agreements and disagreements, AGREE shows the time difference between corresponding observations and calculates Percent Agreement. The information created by AGREE can be used in various interrater reliability calculations. It is also helpful in identifying inconsistencies between coders and training coders to comply with established standards.



DATASET PLAYBACK SYSTEM (**PLAYBACK**)

The Dataset Playback System allows the user to review all entered codes, descriptions, and times while simultaneously watching the videotape which was previously coded. **PLAYBACK** reviews the codes and descriptions in a dataset by displaying them on the computer screen and providing audible feedback at the times they were entered. The user specifies whether only one code, a set of several codes, a class of codes (indicated by wild-card characters), or a complete Dataset is to be reviewed. The system uses the timecode recorded on a videotape's audio track or vertical blanking interval to synchronize the computer and VCR and, therefore, requires an OCS-VCR system. PLAYBACK with optional **Recordable Video Overlay** allows the codes and their descriptions to be viewed on the same screen as the videotape. When used with a **VCR Controller**, PLAYBACK can quickly locate any event on the videotape for verification or review. With PLAYBACK, an operator can verify coded video data, check events and associated codes for accuracy, and efficiently train coders.

PLAYBACK UPGRADE (**PLAYBACK-CTRL**)

The PLAYBACK UPGRADE is designed for hardware platforms which include a VCR-CTRL. The upgrade will integrate the VCR Controller System with an OCS-VCR PLAYBACK system. The VCR-CTRL can then be used within PLAYBACK to locate any event or any frame on the tape. The user can also "mark" sections of tape to work within. Keyboard keys are used to rewind to the previous selected code or the next selected code. To review an event, the user can rewind to the beginning of the code in progress on the screen by pressing a key. The system will also do a "pre-roll" prior to the event in progress. The cursor keys can be used to advance or rewind the videotape one frame at a time.

DATA ANALYSIS TOOLS

Except for **SUMSTAT**, the following data analysis systems are optional components and can be added to any OCS TOOLS package. **SUMSTAT** is included with every OCS Toolset.

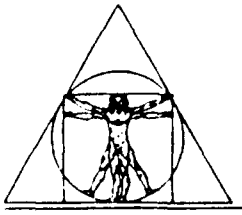
SUMMARY STATISTICS SYSTEM (. **MSTAT**)

The Summary Statistics program analyzes datasets and calculates the frequency and duration of specific events. It provides figures for total frequency, total duration, mean duration, minimum duration, maximum duration, and standard deviation. The user specifies the parameters under which SUMSTAT operates by creating a variable file containing information about the coding method used, the specific events to be analyzed, and the number and name(s) of the dataset(s) to be analyzed.

SUMSTAT then uses this information to analyze a dataset or set of datasets and creates an output file(s).

INTERVAL ANALYSIS SYSTEM (**INTERVAL**)

The Interval Analysis software analyzes intervals within a Dataset and calculates the frequency and duration of specific events. It provides figures for total duration and percent of duration within intervals. The beginning and ending of intervals can be defined by an event determined by the user. The occurrence of this event then signals the end of one interval and the beginning of the next. Intervals of equal duration can be created by adding a marker-code in the dataset to mark the beginning of intervals. External datasets can be defined as a source for interval definitions.



The program also calculates the rate of occurrence of events within intervals. The user specifies the unit of time to be used in the calculation of rate, to obtain a standard measure of frequency across intervals of different lengths. This time unit is called a grouping variable and can range from one second to the length of the entire dataset. By choosing a grouping variable of 60 seconds, for example, it is possible to calculate the rate-per-minute of events during each interval.

TIME SERIES COMPARISON SYSTEM (**TSC**)

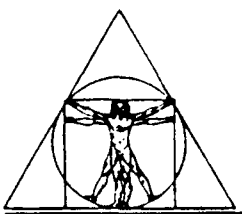
The Time Series Comparison software allows up to 8 comparisons using up to 8 different datasets and/or up to 8 different variable files over a common time period. Time is listed in one column and the codes from each dataset/variable file are listed in adjoining columns. Events to be analyzed can be the same or different for each dataset. The system allows informal comparisons, but does no formal data analysis.

DURATION ANALYSIS SYSTEM (**DURATION**)

The Duration Analysis software lists the consecutive events within a Dataset. Each line of the report includes the duration of each individual incident as well as the cumulative duration of each event. It also includes the time from the dataset as well as the absolute time resulting from correcting the first code's time to 00:00:00.00. One or more events can be selected for analysis, by using a variable file.

PATTERN ANALYSIS SYSTEM (**PATTERN**)

The Pattern Analysis software (PATTERN) allows the user to specify a sequence of up to 10 codes within a dataset and search for all the occurrences of that exact sequence. The software also lists the times and dataset record numbers for each code in each occurrence of the sequence.



Multimedia Tools allow various types of integration between PC and VCR in order to facilitate research involving both personal computers and videotaped data.

The Video Timecode systems write machine readable timecode to each frame of a videotape, and read that timecode when the videotape is being coded. This allows the PC to automatically timestamp each code, and also allows the coder to rewind and recode without affecting accuracy of the data. The Video Tape Controller Systems allow coders to control up to eight VCR's from the PC keyboard. The Recordable Video Overlay System allows computer information to be displayed on the same screen as video.

VIDEO TIMECODE SYSTEMS

VCR-RT TIMECODE SYSTEM

The VCR-RT (Real Time) Timecode System produces machine readable timecode on one audio track of a videotape. It automatically reads and enters time into the dataset each time a code is entered, when videotape is coded at normal "play" speed. The VCR-RT Timecode System consists of a hardware interface, cableset, driver, and complete software integration with OCS-VCR system.

VCR-SMPTE TIMECODE SYSTEM

The VCR-SMPTE Timecode System produces industry standard machine readable timecode on one audio track of a videotape. It automatically reads and enters time into the dataset each time a code is entered, when videotape is coded at normal, fast, or slow speeds (from 1/2 "play" speed to 10x "play" speed). The VCR-SMPTE Timecode System consists of a hardware interface, cableset, driver, and complete software integration with OCS-VCR system.

VCR-VITC TIMECODE SYSTEM

The VCR-VITC Timecode System operates in addition to the VCR-SMPTE system (required). It writes human and machine readable timecode to the video track of a video tape. Time is automatically read and entered into the dataset each time a code is entered when videotape is coded at any speed, including paused or freeze-frame. The VCR-VITC Timecode System consists of a rackmountable hardware interface, cableset, driver, and complete software integration with OCS-VCR system.

VIDEO TAPE CONTROLLER SYSTEMS

VCR-CTRL SYSTEM

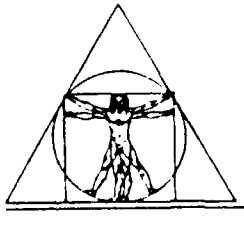
The VCR-CTRL System allows an operator to control a VCR from the PC keyboard. Numerous VCR-CTRL systems (up to 8) can exist in one CPU, providing selectable master/slave configurations for simultaneous operations. The user can rewind, fast forward, record, audio dub, pause, or search using PC keyboard keys. The VCR-CTRL System includes a hardware interface, cableset, software driver, and a memory resident software system for use with any 100% IBM PC compatible software package.

Currently VCR Controllers will operate with these VCR's:

- Panasonic AG6000 series, 34 pin VCR's (6100, 6200, 6300, 6500)
- Panasonic AG7000 series, 34 pin VCR's (7100, 7200, 7300, 7500)
- JVC BR-0000-U series, 45 pin VCR's (5300, 6400, 7700, 8600)
- JVC BRS-000-U series, 45 pin VCR's (611, 711, 811)

The VCR Controller will soon operate with these additional VCR's:

- Sony BVU-8000 series, 36 pin VCR's, and Sony Type-1 Control VCR's
- Panasonic AG-1960



Minimum System Requirements:

- One VCR Controller circuit board for each VCR to be controlled from the PC, software driver, and TSR software system.
- Cable to connect PC with VCR. VCR Controller Cables are VCR specific (i.e. a Panasonic cable will not operate on JVC VCR's).
- IBM PC, AT or 100% compatible computer with one available expansion slot for each VCR to be controlled from the PC keyboard
- From one to eight compatible VCR's

COMPUTER/VIDEO OVERLAY EQUIPMENT

RECORDABLE VIDEO OVERLAY SYSTEM (RVO)

The Recordable Video Overlay System (RVO) allows the user to view video images and computer-generated information on one monitor simultaneously. Coders can choose menu options from the video screen, see the system clock and entered codes, and call up any needed information. This eliminates the need to scan between two monitors during coding. Operators are less likely to miss codable events, resulting in more accurate gathering of data with fewer videotape rewinds.

RVO also allows the user to make videotapes of the information in overlay mode, such as video frame time, event codes, and code descriptions. This eliminates the need to scan between two monitors during **PLAYBACK** sessions. A videotape can be made of previously coded datasets and used to train coders, without the additional requirement of a computer. The RVO system can be used to make videotapes of any computer overlaid video sequence, and is not restricted to use with the OCS TOOLS.

Minimum system requirements:

Two RVO systems are currently available: RVO-E (EGA) and RVO-V (VGA). Both include the EGA or VGA graphics card and software, the RVO hardware and software, and the required cableset. In addition, the following equipment is required to run an RVO System:

- IBM/PC, AT, or 100% compatible computer
- Video monitor or Analog-RGB/Video Monitor with cables
- Video source (e.g. VCR or video camera)
- Video Cassette Recorder with cables (for use as target VCR)

Any standard video monitor can be used with a Recordable Video Overlay system. However, screen colors may be better with an Analog RGB/NTSC monitor. In order to view computer information without underlying video on the same monitor which is also used for video, an Analog RGB/NTSC monitor is required.

The screen quality is best when the RVO System is used in Video Overlay mode and it is recommended that Recordable Video Overlay mode be used only for making recordings. If the system is mainly to be used in Video Overlay mode, it is also required that an Analog/RGB monitor be used rather than a video monitor, since this improves screen color quality when computer information is being viewed. If coding requires that the videotape be paused (freeze framed), it is also recommended that the system include either a monochrome monitor to display computer information during freeze-frame coding, or that a Time Base Corrector (TBC) be installed to properly sync video and computer information on one screen.

Any VCR currently on the market (NTSC standard) can be used. However, S-VHS VCR's are not currently compatible with RVO systems unless a SVHS-TBC is used in the system (call for availability of overlay systems for output to S-VHS VCR's). Slow motion work with an RVO system requires specific video components; call TRC for information.